GEOTECHNICAL ENGINEERING EXPLORATION

PROPOSED APARTMENT BUILDING

LOTS 2 - 5, BLOCK 47, TRACT 5609

2107 - 2121 WESTWOOD BOULEVARD

LOS ANGELES, CALIFORNIA

FOR RBM OF CALIFORNIA, INC.

IRVINE GEOTECHNICAL, INC. PROJECT NUMBER IC 20020-I

MARCH 17, 2020

TABLE OF CONTENTS

INTRODUCTION

This report has been prepared per our agreement and summarizes findings of Irvine Geotechnical's geotechnical engineering exploration performed on the site. The purpose of this study is to evaluate the nature, distribution, and engineering properties of the earth materials underlying the site with respect to the design and construction of the proposed project.

INTENT

It is the intent of this report to assist in the design and completion of the proposed project. The recommendations are intended to reduce geotechnical risks affecting the project. The professional opinions and advice presented in this report are based upon commonly accepted standards and are subject to the general conditions described in the NOTICE section of this report.

EXPLORATION

The scope of the field exploration was determined from our initial site visit and consultation with the client. Exploration was conducted using techniques normally applied to this type of project in this setting. This report is limited to the area of the exploration and the proposed project as shown on the enclosed Site Plan. Conditions affecting portions of the property outside the area explored, are beyond the scope of this report.

Exploration was conducted on January 30, 2020 with the aid of a hollow-stem auger drill rig. It included drilling 4 borings to a maximum depth of 50 feet. Samples of the earth materials were obtained and delivered to the soils engineering laboratory of Soil Labworks, LLC for testing and analysis. The borings were logged by the staff geologist.

Office tasks included laboratory testing of selected soil samples, researching records on file at the City of Los Angeles, reviewing historical topographic maps and aerial photographs, preparing the Site Plan and performing engineering analysis. Earth materials exposed in the borings are described on the enclosed Log of Borings. Appendix I contains a discussion of the laboratory testing procedures and results.

The proposed project and the location of the borings are shown on the Site Plan.

PROPOSED PROJECT

Information concerning the proposed project was provided by the client. The preliminary plans prepared by RBM California were a guide for preparing this report. It is proposed to redevelop the properties with an apartment building. The structure will consist of 5 stories of living and common space over 2 levels of subterranean parking. The roof deck will include common space. Retaining walls between 10 and 25 feet are planned to support excavations for the ramps and basement levels. Grading will include exporting soils from the basement and backfilling retaining walls and ramps. Foundation loads are unknown but are anticipated to be moderate to high.

SITE DESCRIPTION

The subject property consists of 4 contiguous and partially developed lots, in the Rancho Park section of the City of Los Angeles, California. It is located on the west side of Westwood Boulevard, between Olympic Boulevard and Mississippi Avenue, and about equidistant between the San Diego (I-405) Freeway and Rancho Park. The site is developed with several small one-story office/retail buildings and one larger one-story retail building. The remainder of the property os paved and used for parking. The surrounding areas along Westwood Boulevard are developed with similar commercial buildings and the neighborhood to the west is developed with single-family residences.

The lot slopes gently from northwest to southeast and gradients are flatter than 10:1. Physical relief across the property is about 3 feet. The site is devoid of vegetation. Surface drainage generally is by sheet flow runoff down the contours of the land toward the east and southeast.

GROUNDWATER

Groundwater was encountered during exploration in Boring 1 at a depth of 45 feet. Groundwater was not encountered in the shallower borings. Historically highest groundwater in this area of Los Angeles is estimated to be 40 feet below the ground surface (Plate 1.2, *Historically Highest Groundwater Contours and Borehole Log Data Locations, Beverly Hills 7½ Minute Quadrangle in Seismic Hazard Zone Report for the Beverly Hills Quadrangle,* SHZR-023).

EARTH MATERIALS

Fill

Fill, associated with previous site grading and paving, underlies portions of the site to a maximum observed thickness of 18 to 24 inches in the borings. The fill consists of sandy silt that is mottled grey and brown, slightly moist, and firm.

Alluvium

Natural alluvial deposits were encountered to the total depths of the borings. The alluvium consists of weakly stratified layers of sandy silt, silt, silty sand, clayey sand and clay. The alluvium is grey-brown, orange-brown, yellow, and grey, slightly moist to saturated, and medium dense to very dense (sand) and firm to very stiff (silts and clay).

GENERAL SEISMIC CONSIDERATIONS

Southern California is located in an active seismic region and numerous known and undiscovered earthquake faults are present in the region. Hazards associated with fault rupture and earthquakes include direct affects such as strong ground shaking and ground rupture, as well as secondary effects such as liquefaction, landsliding and lurching. The United States Geological Survey (USGS), California Geologic Survey (CGS), Southern California Earthquake Center (SCEC), private consultants and universities have been studying earthquakes in southern California for several decades. Early studies were directed toward earthquake prediction and early warning of strong ground shaking. Research and practice have shown that earthquake prediction is not practical or sufficiently accurate to benefit the general public. Also, several recent and damaging earthquakes have occurred on faults that were unknown prior to rupture. Current standards and the California

Building Code call for earthquake resistant design of structures as opposed to prediction.

Building Code Seismic Coefficients

Seismic design parameters within the Building Code include amplification of the seismic forces on the structure depending on the soil type, distance to seismic source and intensity of shaking. The purpose of the code seismic design parameters is to prevent collapse of structures and loss of life during strong ground shaking. Cosmetic damage should be expected.

The following table lists the applicable seismic coefficients for the 2020 Los Angeles Building Code.

SEISMIC COEFFICIENTS (2020 Los Angeles Building Code)		
Latitude = 34.0916°N Longitude = 118.4416°W	Short Period (0.2s)	One-Second Period
Earth Materials and Site Class Chapter 20 - ASCE 7	Alluvium - D	
Seismic Design Category from Table 1613.2.5(1) and 1613.2.5(2)	D	
Spectral Accelerations from Figures 1613.2.1 (1) through 1613.2.1(8)	S_s = 2.032 (g)	S_1 = 0.725 (g)
Site Coefficients from Tables 1613.2.3 (1) and 1613.2.3 (2)	F_A = 1.2	F_V = 1.7
Spectral Response Accelerations from Equations 16-36 and 16-37	S_{MS} = 2.439 (g)	S_{M1} = 1.233 (g)
Design Accelerations from Equations 16-38 and 16-39	S_{DS} = 1.626 (g)	S_{D1} = 0.822 (g)

Seismic Hazards

The principal seismic hazard to the subject property and proposed project is strong ground shaking from earthquakes produced by local faults. Modern, well-constructed buildings are designed to resist ground shaking through the use of shear panels, moment-resisting frames and reinforcement. Additional precautions may be taken to protect personal property and reduce the chance of injury, including strapping water heaters and securing furniture and appliances. It is likely that the subject property will be shaken by future earthquakes produced in southern California. However, secondary effects such as surface rupture, lurching, liquefaction, consolidation, ridge shattering, and landsliding should not occur at the subject property.

Alquist-Priolo Fault Rupture Hazard Study Zone

California faults are classified as active, potentially active or inactive. Faults from past geologic periods of mountain building, but do not display any evidence of recent offset are considered “inactive” or “potentially active.” Faults that have historically produced earthquakes or show evidence of movement within the Holocene (past 11,000 years) are considered “active faults.” Active faults that are capable of causing large earthquakes may also cause ground rupture. The Alquist-Priolo Act of 1972 was enacted to protect structures from hazards associated with fault ground rupture. No known active faults cross the subject property and the site is not located within an Alquist-Priolo Fault Rupture Hazard Study Zone. The ground rupture hazard at the site is considered nil.

Seismic Hazard Zones

The California State Legislature enacted the Seismic Hazards Mapping Act of 1990, which was prompted by damaging earthquakes in California, and was intended to protect public safety from the effects of strong ground shaking, liquefaction, landslides, and other earthquake-related hazards. The Seismic Hazards Mapping Act requires that the State Geologist delineate various "seismic hazards zones." The maps depicting the zones are released by the California Geological Survey.

The Seismic Hazards Mapping Act requires a site investigation by a certified engineering geologist and/or civil engineer with expertise in geotechnical engineering, for projects sited within a hazard zone. The investigation is to include recommendations for a "minimum level of mitigation" that should reduce the risk of ground failure during an earthquake to a level that does not cause the collapse of buildings for human occupancy. The Seismic Hazards Mapping Act does not require mitigation to a level of no ground failure and/or no structural damage.

Seismic Hazard Zone delineations are based on correlation of a combination of factors, including: surface distribution of soil deposits; physical relief; depth to historic high groundwater; shear strength of the soils; and occurrence of past seismic deformation. The subject property is located within the United States Geologic Survey, Beverly Hills Quadrangle. Seismic hazards within the Beverly Hills Quadrangle were evaluated by the CGS in their report, *"Seismic Hazard Zone Report for the Beverly Hills 7.5-minute Quadrangle, Los Angeles County, California, Seismic Hazard Zone Report* 023." According to the Seismic Hazard Zones Map, the subject property is **not** within an area that has been subject to, or may be subject to liquefaction or earthquake induced ground deformation.

Ground Motion

Spectral accelerations and peak ground accelerations at the site were determined for the Risk-Targeted Maximum Considered Earthquake (MCE_R) and Geometric Mean Peak Ground Acceleration (MCE_G) following the procedures in ASCE 7-16 and the 2019 Building Code. The computed PGA for this site is 0.870g. The adjusted PGA_M for default Site Class D is 1.044g. According to the USGS deaggregation website (https://earthquake.usgs.gov/hazards/interactive/), and using a ground motion with a 10 percent probability of exceedance in 50 years, the modal de-aggregated earthquake PGA and moment magnitude are 0.518g and 6.36, respectively. For a ground motion with a 2 percent probability of exceedance in 50 years, the modal de-aggregated earthquake PGA and moment magnitude are 0.885g and 6.36, respectively. The modal distance to the ground motion source is 4.31 km. It is our understanding that the fundamental period of the proposed building will be less than ½ second.

CONCLUSIONS AND RECOMMENDATIONS

General Findings

The conclusions and recommendations of this exploration are based upon four borings, research of available records, consultation, years of experience observing similar properties in similar settings and review of the development plans. It is the finding of Irvine Geotechnical that construction of the proposed project is feasible from a geotechnical engineering standpoint provided the advice and recommendations contained in this report are included in the plans and are implemented during construction.

The recommended bearing material is the alluvium, which was encountered at depths of 1 to 2 feet in the borings. The existing fill and disturbed soils are not recommended for foundation or slab support. The alluvium will be exposed in excavations for the basement and conventional foundations and slabs are considered appropriate.

Geotechnical Issues

Geotechnical issues affecting the site include temporary excavations adjacent to existing structures and property lines required to construct the basement walls. Shoring will be required.

SITE PREPARATION

Surficial materials consisting of fill are present on the site. Remedial grading is recommended to improve site conditions for any near surface slabs and pavements.

General Grading Specifications

The following guidelines may be used in preparation of the grading plan and job specifications. Irvine Geotechnical would appreciate the opportunity of reviewing the plans to insure that these recommendations are included. The grading contractor should be provided with a copy of this report.

A. The site should be prepared to receive compacted fill by removing all vegetation, debris, existing fill, and disturbed soils. The exposed excavated area should be observed by the soils engineer prior to placing compacted fill. The exposed grade should be scarified to a depth of six inches, moistened to optimum moisture content, and recompacted to 90 percent of the maximum density.

B. Fill, consisting of soil approved by the soils engineer, shall be placed in horizontal lifts and compacted in six inch layers with suitable compaction equipment. The excavated onsite materials are considered satisfactory for reuse in the controlled fills. Any imported fill shall be observed by the soils engineer prior to use in fill areas. Rocks larger than six inches in diameter shall not be used in the fill.

C. The fill shall be compacted to at least 90 percent of the maximum laboratory density for the material used. Where cohesionless soil (less than 15 percent finer than 0.005 millimeters) is used for fill, it shall be compacted to a minimum of 95 percent relative compaction. The fill should be placed at a moisture content that is at or within 3 percent over optimum. The maximum density and optimum moisture content shall be determined by ASTM D 1557-12 or equivalent.

D. Field observation and testing shall be performed by the soils engineer during grading to assist the contractor in obtaining the required degree of compaction and the proper moisture content. Where compaction is less than required, additional compactive effort shall be made with adjustment of the moisture content, as necessary, until 90 percent compaction is obtained. One compaction test is required for each 500 cubic yards or two vertical feet of fill placed.

E. At one time, the site and the former residence may have been serviced by a private sewerage. Private sewage disposal systems generally consist of a septic tank and one or more cesspool or seepage pits. Any seepage pits or cesspools found during grading should be properly abandoned in conformance with the city's guidelines. As a minimum, the liner and debris should be removed to expose the bearing material. The void may then be filled with compacted fill or another approved material.

Shrinking/Bulking

The following table contains the estimated bulking and shrinking factors to be used in determining earthwork volumes. The factors were determined by ratios of in-situ density to compacted density or loose density.

EARTHWORK FACTORS					
Earth Material	In-situ Density (pcf)	Loose Density (pcf)	Compacted Density (pcf)	Bulking Factor (percent)	Shrinking Factor (percent)
Alluvium	105.5	90	119	17.2	11.3

Excavation Characteristics

The borings did not encounter hard, cemented bedrock or boulders. Groundwater was encountered at a depth of 45 feet. Perched seeps could be located shallower than 45 feet and may be encountered and drilled shafts. Water should be pumped from drilled shafts prior to placing concrete. Alternatively, water within drilled shafts may be displaced by pouring the concrete from the bottom-up using a tremmie pipe. The compressive strength of the concrete should be increased by 1,000 psi over the design strength for concrete placed below the water.

FOUNDATION DESIGN

General Conditions

The following foundation recommendations are minimum requirements. The structural engineer may require footings that are deeper, wider, or larger in diameter, depending on the final loads.

Spread Footings

Continuous and/or pad footings may be used to support the proposed structures provided they are founded in alluvium. Continuous footings should be a minimum of 12 inches in width. Pad footings should be a minimum of 24 inches square. The following chart contains the recommended allowable design parameters.

Bearing Material	Minimum Embedment Depth of Footing (Inches)	Vertical Bearing (psf)	Coefficient of Friction	Passive Earth Pressure (pcf)	Maximum Earth Pressure (psf)
Alluvium	18	2,000	0.30	250	5,000

Increases in the bearing value are allowable at a rate of 400 pounds per square foot for each additional foot of footing width or depth to a maximum of 5,000 pounds per square foot. For bearing calculations, the weight of the concrete in the footing may be neglected.

The bearing value shown above is for the total of dead and frequently applied live loads and may be increased by one third for short duration loading, which includes the effects of wind or seismic forces.

The on-site soils are moderately expansive. Footings should be reinforced following the recommendations of the structural engineer. Footings should be cleaned of all loose soil, moistened, free of shrinkage cracks and approved by the geotechnical engineer prior to placing forms, steel or concrete.

Foundation Settlement

Settlement of the foundation system is expected to occur on initial application of loading. A settlement of ¼ to ½ inch may be anticipated. Differential settlement should not exceed ¼ inch.

RETAINING WALLS

General Design - Static Loading

Cantilevered retaining walls for this project are expected to be 12 feet high or less. Basement retaining walls could support excavations up to 25 feet.

Cantilevered retaining walls up to 12 feet high that support alluvium and approved retaining wall backfill, may be designed for an equivalent fluid pressure of 45 pounds per cubic foot per the enclosed calculations. Restrained basement walls that are pinned at the top by a non-yielding floor should be designed for an at-rest earth pressure. The recommended design at-rest earth pressure on restrained basement walls is an equivalent fluid pressure of 70 pcf.

Basement walls that are constructed using shoring and braced, may be designed for a trapezoidal distribution of pressure. The recommended design earth pressure on restrained shoring is 44H, where H is the retained height in feet.

Seismic Surcharge

In conformance with the Building Code, retaining walls higher than 6 feet were considered for seismic loading for the design ground motion resulting from the Maximum Considered Earthquake. The horizontal coefficient of seismic increment (K_E) and seismic increment (P_E) were estimated following procedures by Sitar, N. et. al.,2010, (*Seismic Earth Pressures on Deep Building Basements,* SEAOC 2010 Convention Proceedings). Spectral accelerations at the site were determined for the Maximum Considered Earthquake (MCE) following the procedures in ASCE 7-10 and the 2019 Building Code. The computed PGA_M for this site is 1.044g. The horizontal coefficient of seismic increment (K_E) was assumed to be ⅓(PGA_M) = 0.348g.

The force required in addition to the static design force to raise the safety factor to at least 1.0 (P_E) was checked using a computerized version of the Mononobe-Okabe method. Ground motion was assumed to be 0.348g.

The recommended static and seismic forces for 12- and 22-foot high retaining walls are shown in the following table. Where the unbalanced seismic force is higher than the static design pressure, the seismic increment was converted to an equivalent fluid pressure.

DESIGN EARTH PRESSURES - WALLS > 6 FEET			
Surface Slope Gradient	Static Design Force	Seismic Force*	Seismic Surcharge
Level	12ft^2 * 45 pcf /2=3.240 kips	4.383 kips	16 pcf
Restrained	25ft^2 * 70 pcf /2=21.875 kips	21.383 kips	0 pcf

* See Calculation sheets

Surcharge Loading

Retaining walls that are surcharged by traffic and/or structural loads should be designed to withstand the surcharge. The surcharge loads may be computed following the guidelines in City of Los Angeles P/BC 2020-83 (*Retaining Wall Design*) and P/BC 2017-141 (*Guidelines for Determining Live Loads Surcharge from Sidewalk Pedestrian Traffic and Street Traffic*) or equivalent Boussinesq methods. Irvine Geotechnical would be happy to assist the structural engineer in evaluating the surcharge pressure and the point of application from concentrated structural loads.

Subdrain

The recommended design earth pressures assume a free-draining backfill and no buildup of hydrostatic pressures. Retaining walls should be provided with a subdrain or weepholes covered with a minimum of 12 inches of ¾ inch crushed gravel. Not all subdrain systems and pipes are approved by all Building Departments. It is recommended that the Building Department be consulted when using non-conventional systems. The subdrain system should discharge to the atmosphere or to an engineered sump via gravity. Surface drains should not be connected to the subdrain system.

Backfill

Retaining wall backfill should be compacted to a minimum of 90 percent of the maximum density as determined by ASTM D 1557-12. Where access between the retaining wall and the temporary excavation prevents the use of compaction equipment and the retained height is less than 10 feet, retaining walls should be backfilled with ¾-inch crushed gravel to within 2 feet of the ground surface. Where the area between the wall and the excavation exceeds 18 inches or the retained height is more than 10 feet, the gravel must be vibrated or wheel-rolled and tested for compaction. The upper 2 feet of backfill above the gravel should consist of a compacted fill blanket to the surface. Retaining wall backfill should be capped with a paved surface drain or a concrete slab.

TEMPORARY EXCAVATIONS

Temporary excavations will be required to construct the proposed retaining walls. The excavations could be up to 27 feet in height. Where not surcharged by existing footings or structures, the soils are capable of maintaining vertical excavations up to 5 feet. Where vertical excavations exceed 5 feet in height, the upper portion should be trimmed to 1:1 (45 degrees).

It should be noted that regardless of stability, excavations that remove lateral support from property lines or existing structures are not allowed by the Code. The following section from Chapter 33 of the Building Code governs temporary excavations:

3307.3 Temporary excavations and shoring.

3307.3.1 General. Excavations shall not remove the lateral support from a public way, from an adjacent property or from an existing structure. For the purpose of this section, the lateral support shall be considered to have been removed when any of the following conditions exist:

1. The excavation exposes any adverse geological formations, which would affect the lateral support of a public way or an adjacent structure.

2. The excavation extends below a plane extending downward at an angle of 45 degrees from the edge of the public way or an adjacent property.

Exception: Normal footing excavations not exceeding two feet in depth will not be construed as removing lateral support.

3. The excavation extends below a plane extending downward at an angle of 45 degrees from the bottom of an existing structure.

Vertical excavations removing lateral or vertical support from existing foundations or property lines will require the use of temporary shoring.

Shoring

Temporary shoring should be designed for an equivalent fluid pressure of 40 pounds per cubic foot per the enclosed calculations. Shoring that is integrated into the permanent retaining walls should be designed for earth pressures conforming to the RETAINING WALL section of this report.

Shoring may consist of cast-in-place concrete piles with wood lagging. Shoring piles should be a minimum of 12 inches in diameter and a minimum of 6 feet into alluvium below the base of the excavation. Piles may be assumed fixed 3 feet below the base of the excavation. For the vertical forces, piles may be designed for a skin friction of 300 pounds per square foot for that portion of pile in contact with the alluvium. Soldier piles should be spaced a maximum of 10 feet on center.

The friction value is for the total of dead and frequently applied live loads and may be increased by one third for short duration loading, which includes the effects of wind or seismic forces. Resistance to lateral loading may be provided by passive earth pressure within the alluvium below the base of the excavation.

Passive earth pressure may be computed as an equivalent fluid having a density of 250 pounds per cubic foot. The maximum allowable earth pressure is 3,500 pounds per square foot. For design of isolated piles, the allowable passive and maximum earth pressures may be increased by 100 percent. Piles spaced more than 3 pile diameters on center may be considered isolated.

Surcharge Loading

Shoring that is surcharged by traffic and/or structural loads should be designed to withstand the surcharge. The surcharge loads may be computed following the guidelines in City of Los Angeles P/BC 2017-141 (*Guidelines for Determining Live Loads Surcharge from Sidewalk Pedestrian Traffic and Street Traffic*) or equivalent Boussinesq and site-specific methods.

Irvine Geotechnical would be happy to assist the shoring engineer in evaluating the surcharge pressure and the point of application from concentrated structural loads.

Lagging

Due to the sandy nature of the alluvium, lagging will be required between piles. Due to arching in the soils, the pressure on the lagging will be less than that on the shoring piles. It is recommended that the lagging be designed for the full design pressure but be limited to a maximum of 400 pounds per square foot. The void between the lagging and the back-cut should be slurry-filled and observed by a representative of the geotechnical engineer.

Earth Anchors

Earth anchors (tie backs) may be employed to assist the shoring system. Pressure grouted anchors are recommended. The active wedge angle behind shoring is assumed to be a 30-degree plane (measured from the vertical). The bonded length of earth anchors should extend at least 15 feet beyond the active wedge. For preliminary design, an allowable bond friction between the anchors and the soil beyond the active wedge of 300 psf and 2,000 psf may be assumed for gravity-cast and post-grouted anchors, respectively. According to the Post-Tensioning Institute, *Recommendations for Prestressed Rock and Soil Anchors, Table 6.3,* an allowable bond stress of 2,000 psf should be acceptable for post-grouted anchors.

Testing of a percentage of the initial and representative anchors to 200 percent of the design is recommended to verify the assumptions. The remaining anchors should be tested to at least 150 percent of design. The installation and testing should conform to the recommendations of the shoring engineer and City of Los Angeles Guidelines. The testing should also be observed by a representative of the geotechnical engineer. Failure or excessive movement of anchors may require longer bond length, additional post-grouting or additional anchors.

Raker Footings

A bearing value of 3,000 psf may be assumed for inclined raker footings. A coefficient of sliding friction of 0.30 may be assumed along the base of the footing. Passive pressure may be assumed to be 250 pcf.

Deflection Monitoring

Prior to construction and excavation for the project, it is recommended that the existing conditions along the property lines be documented and surveyed. Documentation should include photographs and descriptions of the offsite structures and conditions. Survey monuments should be affixed to representative structures and to points along the property line and offsite. The survey points should be measured prior to construction to form a baseline for determining settlement and/or deformation. Upon installation of the shoring system, survey monuments should be affixed to the tops of representative piles so that deflection can be measured.

Some deflection is expected for a well designed and constructed cantilevered shoring system. For shoring supporting private properties it is recommended that deflection be limited to ½ inch or less. For shoring supporting the street, it is recommended that deflection be limited to 1 inch or less.

The shored excavations and offsite structures should be visually inspected everyday. Survey monuments should be measured once a month during the construction process. Should the surveys reveal offsite deformation or excessive deflection of the shoring system, the shoring engineer and geotechnical engineer should be notified. Excessive deflection may require additional anchors and/or internal bracing to restrain the shoring system.

A representative of the geotechnical engineer should be present during grading to see temporary slopes. All excavations should be stabilized within 30 days of initial excavation. Water should not be allowed to pond on top of the excavations nor to flow toward them. No vehicular surcharge should be allowed within three feet of the top of the cut.

CORROSION

The pH of the soils is near neutral and not a factor in corrosion. The chloride content is low and not a factor in design. The sulfate content is negligible and not a factor in concrete design. The resistivity indicates that the soils are corrosive to ferrous metals.

CONCRETE DECKING

Concrete slabs and ramps above the mat should be cast over firm alluvium or approved compacted fill. The undisturbed natural soils will provide adequate support to the basement slab. Any large cobbles that are encountered at the planned subterranean level should be removed and replaced with finer compacted material to obtain a level subgrade. To provide uniform slab support, the soils required to backfill voids should be compacted to at least 95 percent. Construction activities and prolonged exposure to the environment can cause deterioration of prepared subgrades. Therefore, we recommend that appropriate tests be conducted on the final subgrade soils immediately prior to slab on grade construction to determine their condition and requirements for any remedial grading.

Floor slabs within the building that are subject to vehicle loads should be at least 5 inches thick and reinforced with a minimum of #4 bars on 16 inch centers, each way. Exterior slabs should be at least 4 inches thick and reinforced with a minimum of #4 bars on 16 inch centers, each way. Care should be taken to cast the reinforcement near the center of the slab.

Slabs which will be provided with a moisture-sensitive floor covering should be designed to resist moisture in conformance with ACI 302.2R-06 (*Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Material*). Specifications for under-slab vapor retarder/barrier are typically the responsibility of the architect or flooring specialist. We would be happy to assist the architect and/or flooring specialist on their specifications for moisture protection of slabs that are to receive moisture sensitive coverings.

Many agencies require floor slabs be constructed in conformance with the Green Building Code that requires slabs be poured directly on top of the vapor barrier, which is to be underlain by four inches of gravel. Since the vapor barrier is to be placed on the gravel, it is important to exercise care to prevent damaging the moisture barrier during construction. From a geotechnical engineering standpoint, a vapor barrier may be placed over 4 inches of gravel, provided that the vapor barrier is of sufficient strength to resist punctures and tearing. If plastic sheeting is used, this may require a greater than 10 mil thickness. Bentonitic barriers such as Miraclay or Volclay may also be used as long as they conform to the minimum requirements of durability, strength and waterproofing. Vapor barriers should conform to ASTM E 1745 and ACI 302.2R-06 (Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials).

Decking that caps a retaining wall should be provided with a flexible joint to allow for the normal one to two percent deflection of the retaining wall. Decking that does not cap a retaining wall should not be tied to the wall. The space between the wall and the deck will require periodic caulking to prevent moisture intrusion into the retaining wall backfill.

It should be noted that cracking of concrete floor slabs is very common during curing. The cracking occurs because concrete shrinks as it dries. Crack control joints which are commonly used in exterior decking to control such cracking are normally not used in interior slabs. The reinforcement recommended above is intended to reduce cracking and its proper placement is critical to the slab's performance. The minor shrinkage cracks which often form in interior slabs generally do not present a problem when carpeting, linoleum, or wood floor coverings are used. The slab cracks can, however, lead to surface cracks in brittle floor coverings such as ceramic tile. A mortar bed or slip sheet is recommended between the slab and tile to limit, the potential for cracking.

Slabs should be protected with a polyethylene plastic vapor barrier placed beneath the slab. This barrier is intended to prevent the upward migration of moisture from the subgrade soils through the porous concrete slab. It should be noted that vapor barriers are penetrated by any number of elements including water lines, drain lines, and footings. These barriers are therefore not completely watertight. It is recommended that a surface seal be placed on slabs which will receive a wood floor. The floor installer should be consulted regarding an adequate product.

DRAINAGE

Control of site drainage is important for the performance of the proposed project. Pad and roof drainage should be collected and transferred to the street or approved location in non-erosive drainage devices. Drainage should not be allowed to pond on the pad or against any foundation or retaining wall. Planters located within retaining wall backfill should be sealed to prevent moisture intrusion into the backfill. Drainage control devices require periodic cleaning, testing and maintenance to remain effective.

Infiltration

Infiltration testing was performed of soils between 25 and 40 feet and the measured infiltration rate is less than 0.03 inches an hour. Due to the depth of groundwater relative to the basement and the measured low infiltration rate, onsite infiltration of surface runoff is not considered feasible.

WATERPROOFING

Interior and exterior retaining walls are subject to moisture intrusion, seepage, and leakage and should be waterproofed. Waterproofing paints, compounds, or sheeting can be effective if properly installed. Equally important is the use of a subdrain that daylights to the atmosphere. The subdrain should be covered with ¾ inch crushed gravel to help the collection of water. Yard areas above the wall should be sealed or properly drained to prevent moisture contact with the wall or saturation of wall backfill.

PLAN REVIEW

Formal plans ready for submittal to the Building Department should be reviewed by Irvine Geotechnical. Any change in scope of the project may require additional work.

SITE OBSERVATIONS DURING CONSTRUCTION

Please advise Irvine Geotechnical at least 24 hours prior to any required site visit. The agency approved plans and permits should be at the jobsite and available to our representative. The project consultant will perform the observation and post a notice at the jobsite of his visit and findings. This notice should be given to the agency inspector.

During construction, a number of reviews by this office are recommended to verify site geotechnical conditions and conformance with the intent of the recommendations for construction. Although not all possible geotechnical observation and testing services are required by the reviewing agency, the more site reviews requested, the lower the risk of future problems. It is recommended that all grading, foundation, and drainage excavations be seen by a representative of the geotechnical engineer PRIOR to placing fill, forms, pipe, concrete, or steel. Any fill which is placed should be approved, tested, and verified if used for engineering purposes. Temporary excavations should be observed by a representative of the Geotechnical Engineer.

The following site reviews are advised or required. Should the observations reveal any unforeseen hazards, the engineer will recommend treatment.

Pre-construction meeting	Advised

Temporary excavations	Required
Shoring pile and lagging installation	Required
Bottom excavation for removals	Required
Subdrains	Required
Compaction of fill	Required
Foundation excavations	Required
Slab subgrade moisture barrier membrane	Advised
Slab subgrade rock placement	Advised
Slab steel placement	Advised
Subdrain and rock placement behind retaining walls	Required
Compaction of retaining wall backfill	Required
Compaction of utility trench backfill	Advised

Irvine Geotechnical requires at least a 24 hour notice prior to any required site visits. The approved plans and building/grading permits should be on the job and available to the project consultant.

FINAL INSPECTION

Many projects are required by the agency to have final geologic and soils engineering reports upon completion of the grading.

CONSTRUCTION SITE MAINTENANCE

It is the responsibility of the contractor to maintain a safe construction site. When excavations exist on a site, the area should be fenced and warning signs posted. All pile excavations must be properly covered and secured. Soil generated by foundation and subgrade excavations should be either removed from the site or properly placed as a certified compacted fill. Soil must not be spilled over any descending slope. Workers should not be allowed to enter any unshored trench excavations over five feet deep.

GENERAL CONDITIONS

This report and the exploration are subject to the following NOTICE. Please read the NOTICE carefully, it limits our liability.

NOTICE

In the event of any changes in the design or location of any structure, as outlined in this report, the conclusions and recommendations contained herein may not be considered valid unless the changes are reviewed by us and the conclusions and recommendations are modified or reaffirmed after such review.

The subsurface conditions, excavation characteristics, and geologic structure described herein and shown on the enclosed cross sections have been projected from excavations on the site as indicated and should in no way be construed to reflect any variations that may occur between these excavations or that may result from changes in subsurface conditions.

Fluctuations in the level of groundwater may occur due to variations in rainfall, temperature, irrigation, and other factors not evident at the time of the measurements reported herein. Fluctuations also may occur across the site. High groundwater levels can be extremely hazardous. Saturation of earth materials can cause subsidence or slippage of the site.

If conditions encountered during construction appear to differ from those disclosed herein, notify us immediately so we may consider the need for modifications. Compliance with the design concepts, specifications or recommendations during construction requires the review of the geotechnical engineer during the course of construction.

THE EXPLORATION WAS PERFORMED ONLY ON A PORTION OF THE SITE, AND CANNOT BE CONSIDERED AS INDICATIVE OF THE PORTIONS OF THE SITE NOT EXPLORED.

This report is issued and made for the sole use and benefit of the client, is not transferable and is as of the exploration date. Any liability in connection herewith shall not exceed the fee for the exploration. No warranty, expressed or implied, is made or intended in connection with the above exploration or by the furnishing of this report or by any other oral or written statement.

THIS REPORT WAS PREPARED ON THE BASIS OF THE PRELIMINARY DEVELOPMENT PLAN OR CONCEPT FURNISHED. FINAL PLANS SHOULD BE REVIEWED BY THIS OFFICE AS ADDITIONAL GEOTECHNICAL WORK MAY BE REQUIRED.

Irvine Geotechnical appreciates the opportunity to provide our service on this project. Any questions concerning the data or interpretation of this report should be directed to the undersigned.

Respectfully submitted,
Irvine Geotechnical, Inc.

Jon A. Irvine
E.G. 1691/G.E. 2891
\\IGPAFC3\Final\ICprojects\2020 Projects\IC20020 RBM Westwood\IC20020 RBM Westwood Report2.wpd

Enc: Appendix I - Laboratory Testing by Soil Labworks
- Moisture-Density Relationship (Plate A)
- Shear Test Diagrams (Plates B-1 through B-3)
- Consolidation Diagrams (Plates C-1 through C-7)

Vicinity Map
Regional Geologic Map
Log of Borings (7 Pages)
Calculation Sheets (4)
Site Plan

xc: (4) Addressee

STATEMENT OF RESPONSIBILITY - SOIL TESTING BY SOIL LABWORKS, LLC

Laboratory testing by Soil Labworks, LLC was performed under the supervision of the undersigned engineer. Irvine Geotechnical and Jon A. Irvine has reviewed referenced laboratory testing report dated February 24, 2020 and the results appear to be reasonable for this area of Los Angeles. Irvine Geotechnical and the undersigned engineer concurs with the findings of Soil Labworks, LLC and accepts professional responsibility for utilizing the data.

SOIL LABWORKS LLC

SL20.3260
February 24, 2020

Irvine Geotechnical
145 N. Sierra Madre Boulevard
Suite 1
Pasadena, California 91107

Subject: Laboratory Testing

Site: 2121 Westwood
Los Angeles, California

Job: IRVINE/RBM-WESTWOOD

Laboratory testing for the subject property was performed by Soil Labworks, LLC., under the supervision of the undersigned Engineer. Samples of the earth materials were obtained from the subject property by personnel of Irvine Geotechnical and transported to the laboratory of Soil Labworks for testing and analysis. The laboratory tests performed are described and results are attached.

Services performed by this facility for the subject property were conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions.

Respectfully Submitted:

SOIL LABWORKS, LLC

JON A. IRVINE
G.E. 2891

REGISTERED PROFESSIONAL ENGINEER
JON ALAN IRVINE
GE 2891
Exp. 6-30-20
GEOTECHNICAL
STATE OF CALIFORNIA

Enc: Appendix

2500 Townsgate Road, Suite E, Westlake Village, California 91361
(805) 370-1338 FAX (805) 371-4693

APPENDIX

Laboratory Testing

Sample Retrieval - Drill Rig

Samples of earth materials were obtained at frequent intervals by driving a thick-walled steel sampler conforming to the most recent version of ASTM D 3550/D 3550M-17 with successive drops of a 140 pound hammer falling 30". The earth material was retained in brass rings of 2.416 inches inside diameter and 1.00 inch height. The central portion of the sample was stored in close-fitting, water-tight containers for transportation to the laboratory.

Moisture Density

The field moisture content and dry density were determined for each of the soil samples. The dry density was determined in pounds per cubic foot following ASTM 2937-17e2. The moisture content was determined as a percentage of the dry soil weight conforming to ASTM 2216-19. The results are presented below in the following table. The percent saturation was calculated on the basis of an estimated specific gravity. Description of earth materials used in this report and shown on the attached Plates were provided by the client.

Test Pit/Boring No.	Sample Depth (Feet)	Soil Type	Dry Density (pcf)	Moisture Content (percent)	Percent Saturation (G_s=2.65)
B1	5	Alluvium	89.4	8.2	26
B1	10	Alluvium	108.2	3.7	19
B1	15	Alluvium	96.8	8.4	32
B1	20	Alluvium	97.6	12.1	46
B1	25	Alluvium	96.2	11.3	12
B1	30	Alluvium	108.3	8.5	43
B1	35	Alluvium	124.0	7.1	57
B1	40	Alluvium	109.8	18.5	97
B1	45	Alluvium	123.3	12.3	95
B1	50	Alluvium	111.8	16.2	90
B2	5	Alluvium	94.9	9.5	34
B2	10	Alluvium	104.4	6.1	28
B2	15	Alluvium	92.1	11.5	39
B2	20	Alluvium	99.5	10.4	12
B2	25	Alluvium	113.7	6.4	37
B2	30	Alluvium	117.1	14.9	95

Moisture Density (continued)

Test Pit/Boring No.	Sample Depth (Feet)	Soil Type	Dry Density (pcf)	Moisture Content (percent)	Percent Saturation (G_s=2.65)
B3	5	Alluvium	112.2	16.4	92
B3	10	Alluvium	106.8	12.6	61
B3	15	Alluvium	107.2	13.6	66
B3	20	Alluvium	104.8	15.9	73
B3	25	Alluvium	110.1	14.1	74
B3	30	Alluvium	95.2	26.4	95
B4	5	Alluvium	98.5	12.4	48
B4	10	Alluvium	117.3	5.6	37
B4	15	Alluvium	105.1	12.9	60
B4	20	Alluvium	104.9	19.3	89
B4	25	Alluvium	103.6	16.0	71
B4	30	Alluvium	100.8	19.9	82

Compaction Character

Compaction tests were performed on bulk samples of the earth materials in accordance with ASTM D1557-12ei. The results of the tests are provided on the table below and on the "Moisture-Density Relationship", A-Plates. The specific gravity of the alluvium was estimated from the compaction curves.

Test Pit/Boring No.	Sample Depth (Feet)	Soil Type	Maximum Dry Density (pcf)	Optimum Moisture Content (Percent)
B4	5-10	Alluvium	129.1	9.0

Shear Strength

The peak and ultimate shear strengths of the alluvium were determined by performing consolidated and drained direct shear tests in conformance with ASTM D3080/D3080M-11. The tests were performed in a strain-controlled machine manufactured by GeoMatic. The rate of deformation was 0.01 inches per minute. Samples were sheared under varying confining pressures, as shown on the "Shear Test Diagrams," B-Plates. Remolded samples were prepared at 90 percent of the maximum density for shear tests. The remolding procedure consists of selecting a representative sample from a bulk bag and sieving it through a No. 4 sieve. The moisture content of the material is then determined. A formula is then used to calculate the weight of the material that must fit in a ring when compacted to 90 percent of the maximum density. This calculated amount of material is then weighed out and pounded into a ring until all the material is used and the ring is full. The moisture conditions during testing are shown on the following table and on the B-Plates. The samples indicated as saturated were artificially saturated in the laboratory. All saturated samples were sheared under submerged conditions.

Shear Strength (continued)

Test Pit/ Boring No.	Sample Depth (Feet)	Dry Density (pcf)	As-Tested Moisture Content (percent)
B1	5	89.4	28.2
B2	5	94.9	28.6
B3	20	104.8	25.7
B4*	0-5	116.2	16.9

* Sample remolded to 90 % of the laboratory maximum density.

Consolidation

One-dimensional consolidation tests were performed on samples of the alluvium in a consolidometer manufactured by GeoMatic in conformance with ASTM D2435/D2435M-11. The tests were performed on 1-inch high samples retained in brass rings. The samples were initially loaded to approximately ½ of the field over-burden pressure and then unloaded to compensate for the effects of possible disturbance during sampling. Loads were then applied in a geometric progression and resulting deformation recorded. Water was added at a specific load to determine the effect of saturation. The results are plotted on the "Consolidation Test," C-Plates.

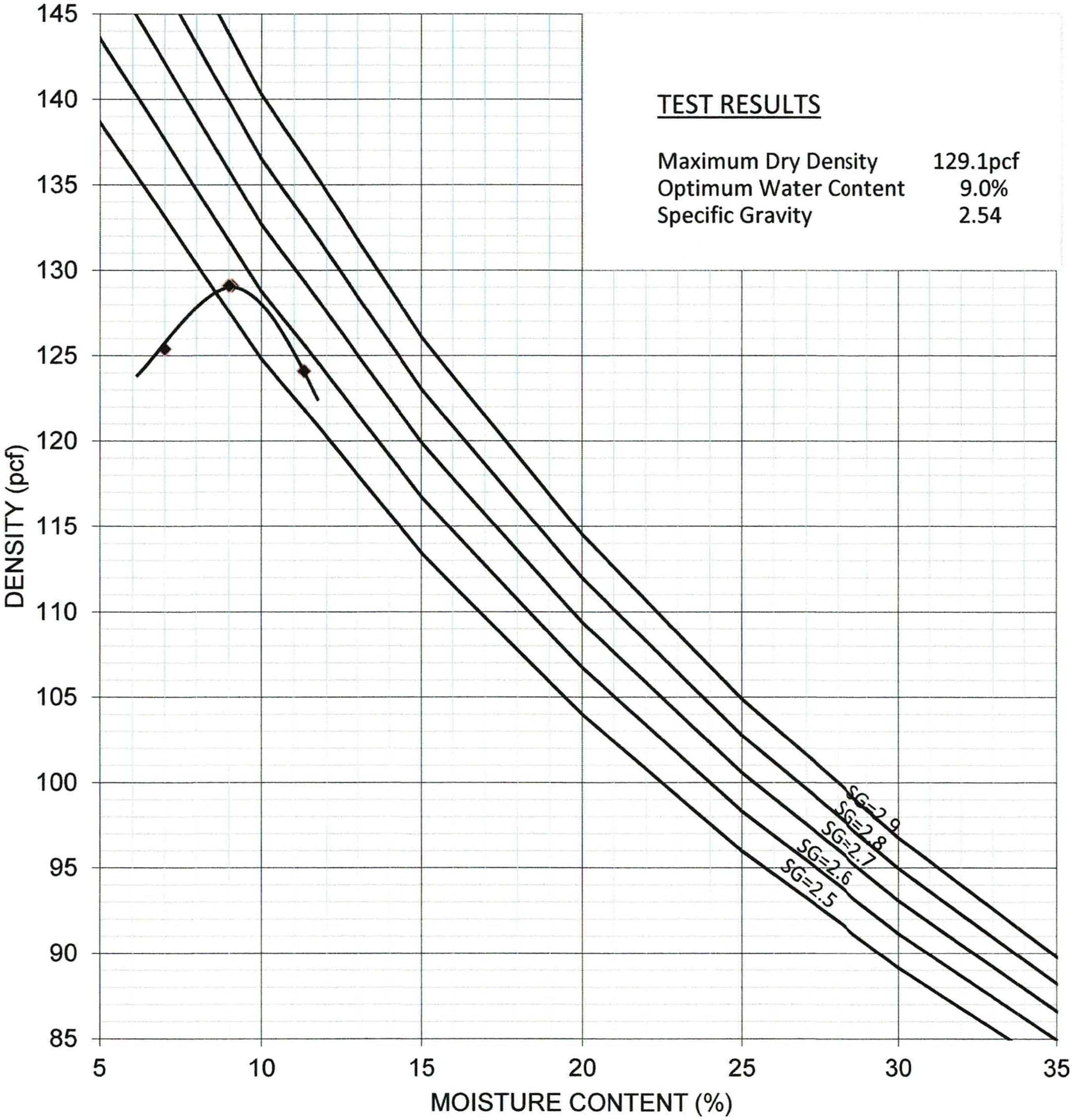
Expansion Index

The expansive character of the alluvium was determined by performing Expansion Index Tests in accordance with UBC 18.2 and ASTM 4829-11. A bulk sample of earth material was compacted at a specific moisture content using one fifth the compacted energy for the modified proctor test. The sample was then saturated and the expansion measured. The results of the tests are provided on the following table.

Test Pit No.	Sample Depth (Feet)	Soil Type	Expansion Index
B4	5-10	Alluvium	27

SOIL LABWORKS LLC	MOISTURE-DENSITY RELATIONSHIP A-1
	JN: **SL20.3260** CONSULTANT: **JAI** CLIENT: **IRVINE/RBM-2121 Westwood** **TP4 @ 5-10'** EARTH MATERIAL: **ALLUVIUM**

NOTE: ASTM Test Method D-1557-12



TEST RESULTS

Maximum Dry Density	129.1pcf
Optimum Water Content	9.0%
Specific Gravity	2.54

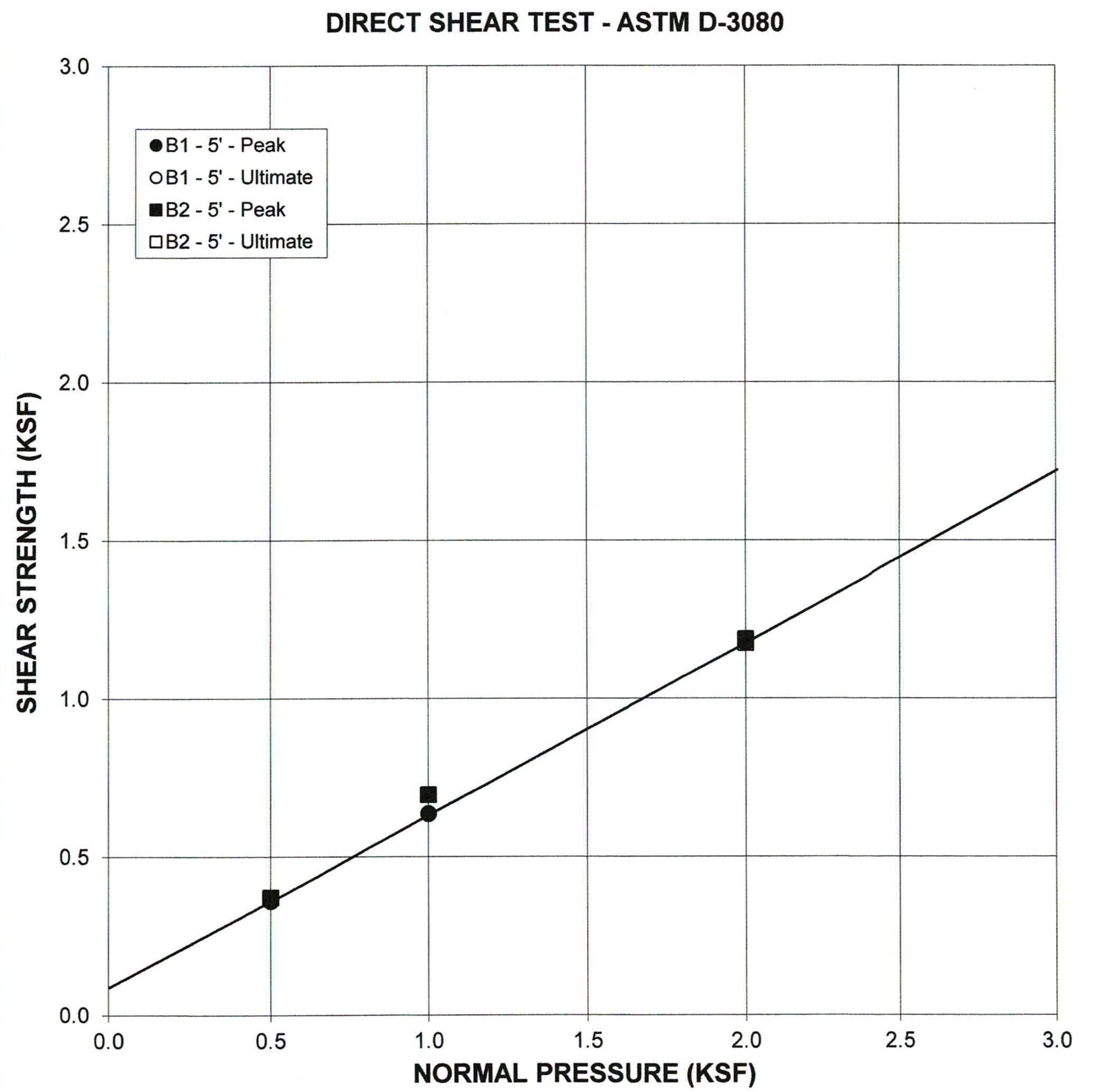
SHEAR DIAGRAM B-1

JN: SL20.3260 CONSULTANT JAI
CLIENT: Irvine/RBM-2121 Westwood

EARTH MATERIAL: ALLUVIUM

	PEAK	ULTIMATE	
Phi Angle	28	28	degrees
Cohesion	85	85	psf

Average Moisture Content	28.4%
Average Dry Density (pcf)	92.2
Percent Saturation	94.8%



SHEAR DIAGRAM B-2

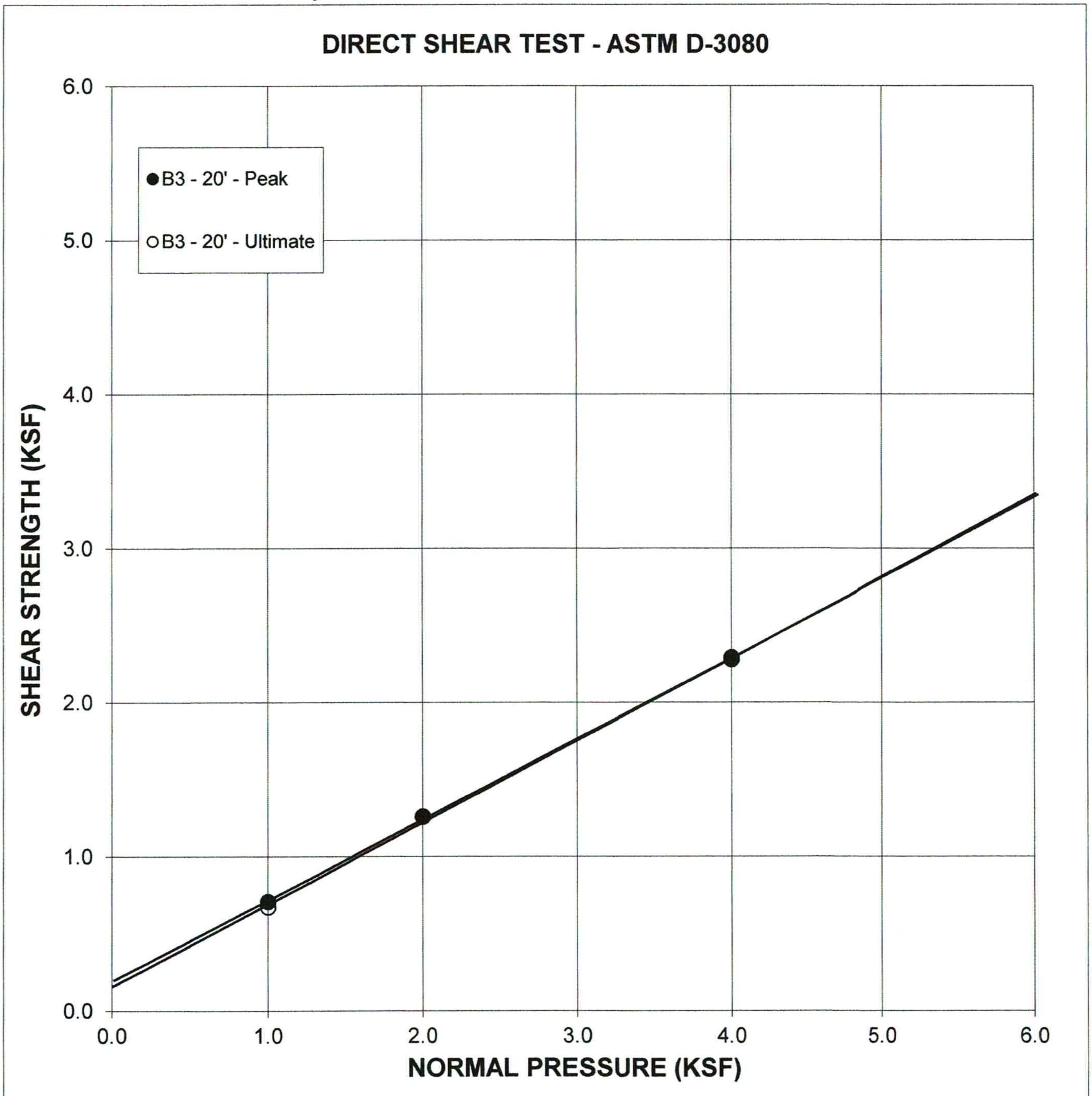
SOIL LABWORKS LLC

JN: **SL20.3260** CONSULTANT **JAI**
CLIENT: **Irvine/RBM-2121 Westwood**

EARTH MATERIAL: **ALLUVIUM**

	PEAK	ULTIMATE	
Phi Angle	27	27.5	degrees
Cohesion	90	70	psf

Average Moisture Content	25.7%
Average Dry Density (pcf)	104.8
Percent Saturation	100.0%



SHEAR DIAGRAM B-3

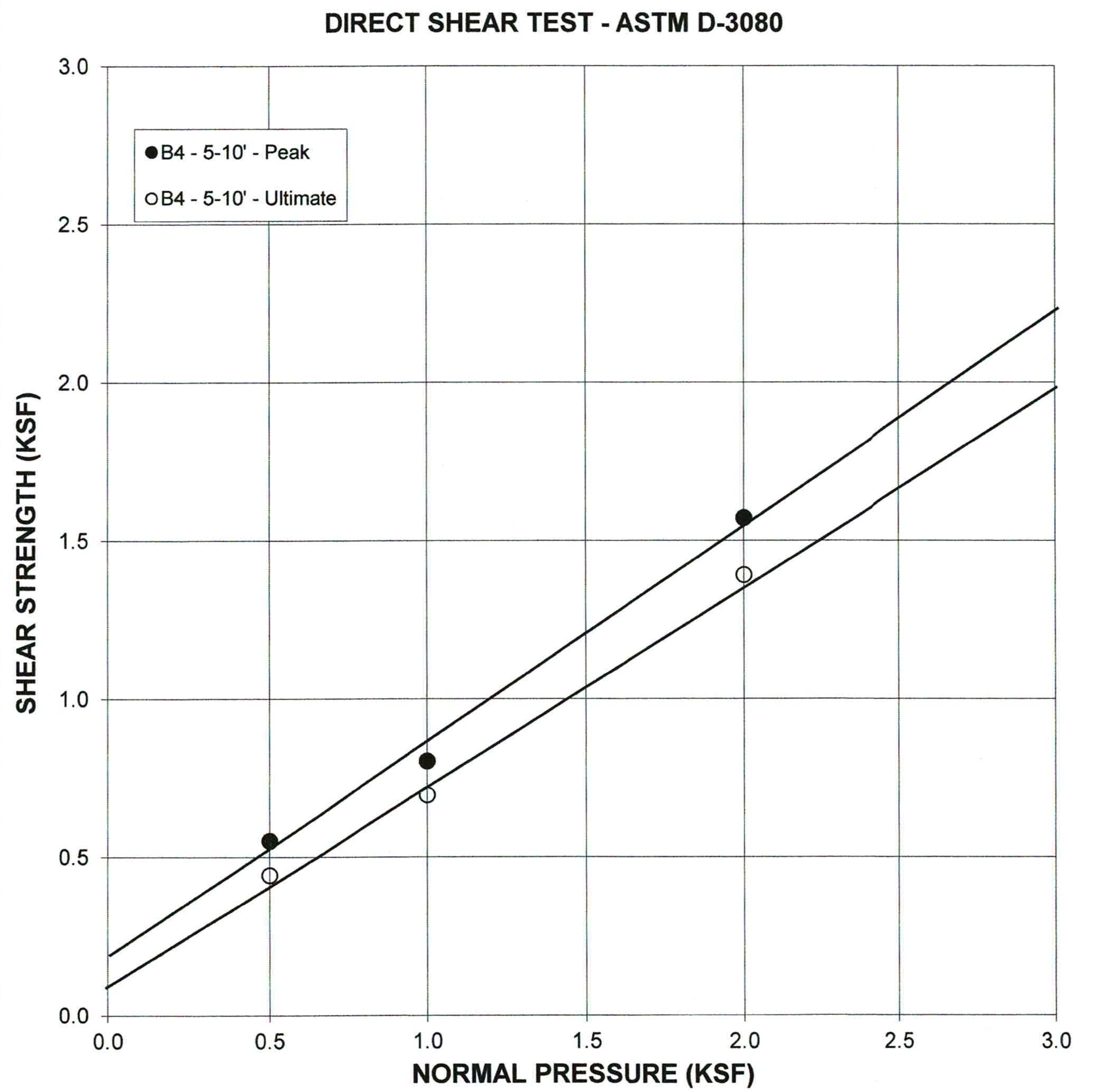
JN: SL20.3260 CONSULTANT JAI
CLIENT: Irvine/RBM-2121 Westwood

EARTH MATERIAL: ALLUVIUM

Sample remolded to 90 % of the laboratory maximum density

	PEAK	ULTIMATE	
Phi Angle	34	32	degrees
Cohesion	180	85	psf

Average Moisture Content	16.9%
Average Dry Density (pcf)	116.2
Percent Saturation	100.0%



SOIL LABWORKS LLC

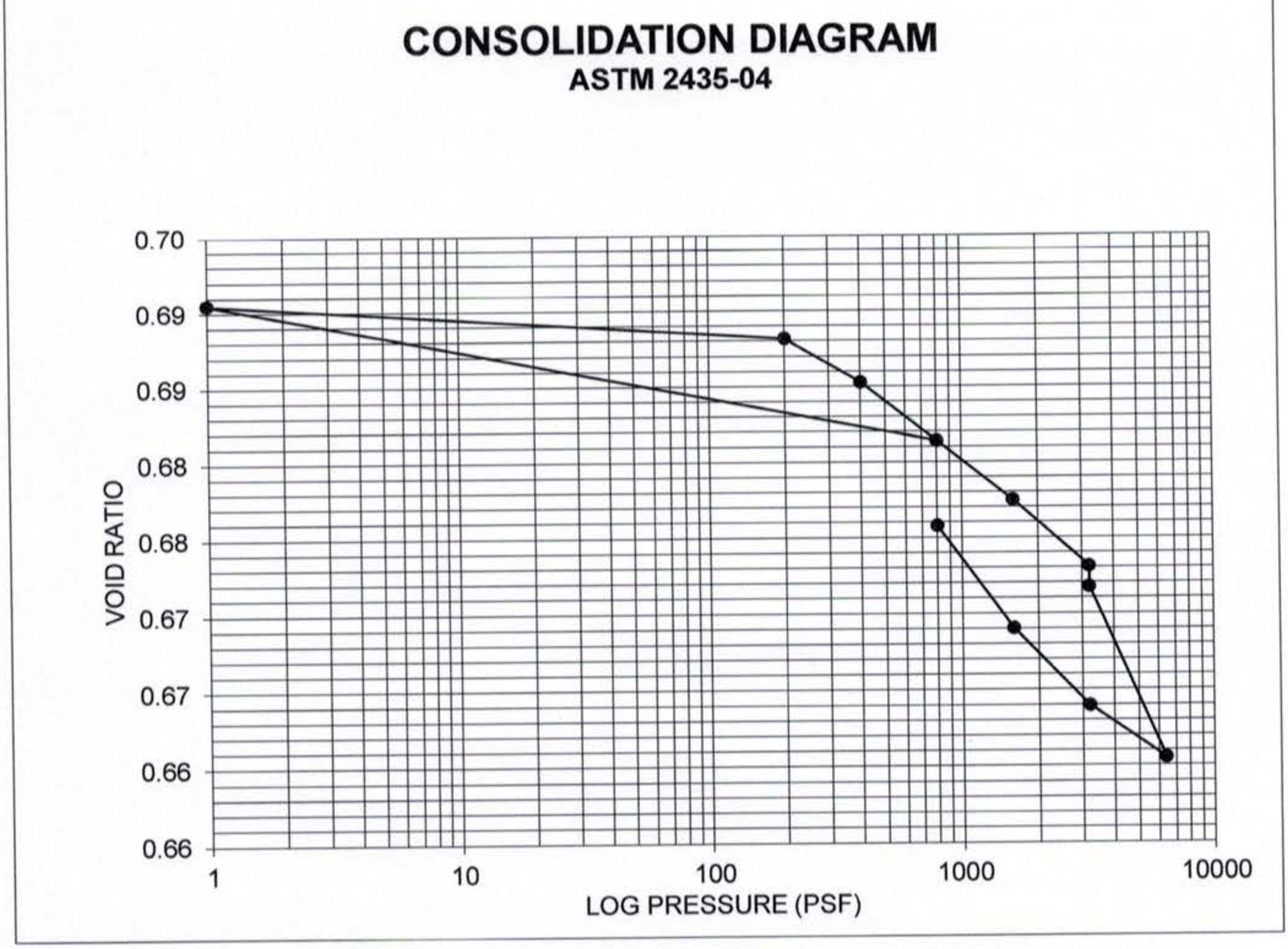
CONSOLIDATION DIAGRAM #1

IC: **20020** CONSULTANT: **JAI**

CLIENT: **RBM WESTWOOD**

PLATE C-1

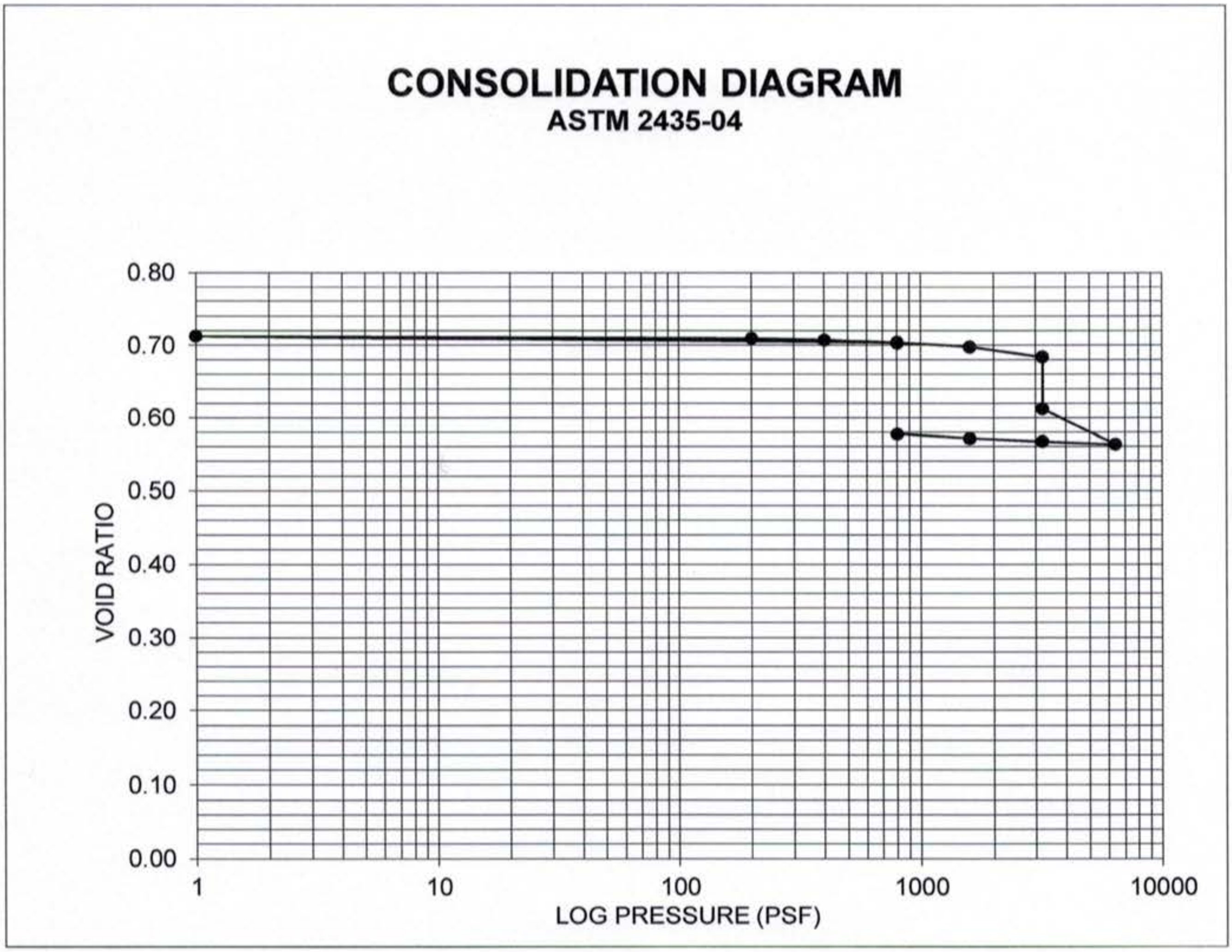
Earth Material:	Alluvium		
Sample Location:	B1@20'	Specific Gravity:	2.65
Dry Weight (pcf):	97.6	Initial Void Ratio:	0.694
Initial Moisture:	12.1%	Water Added At (psf):	3200
Initial Saturation:	46.2%	Consolidation Coef. (Cc):	0.0371
		Reloading Coef. (Cr):	0.0031



SOIL LABWORKS LLC	**CONSOLIDATION DIAGRAM #2**
	IC: **20020** CONSULTANT: **JAI**
	CLIENT: **RBM WESTWOOD**

PLATE C-2

Earth Material:	Alluvium		
Sample Location:	B1@25'	Specific Gravity:	2.65
Dry Weight (pcf):	96.1	Initial Void Ratio:	0.720
Initial Moisture:	11.3%	Water Added At (psf):	3200
Initial Saturation:	41.6%	Consolidation Coef. (Cc):	0.1634
		Reloading Coef. (Cr):	0.0030

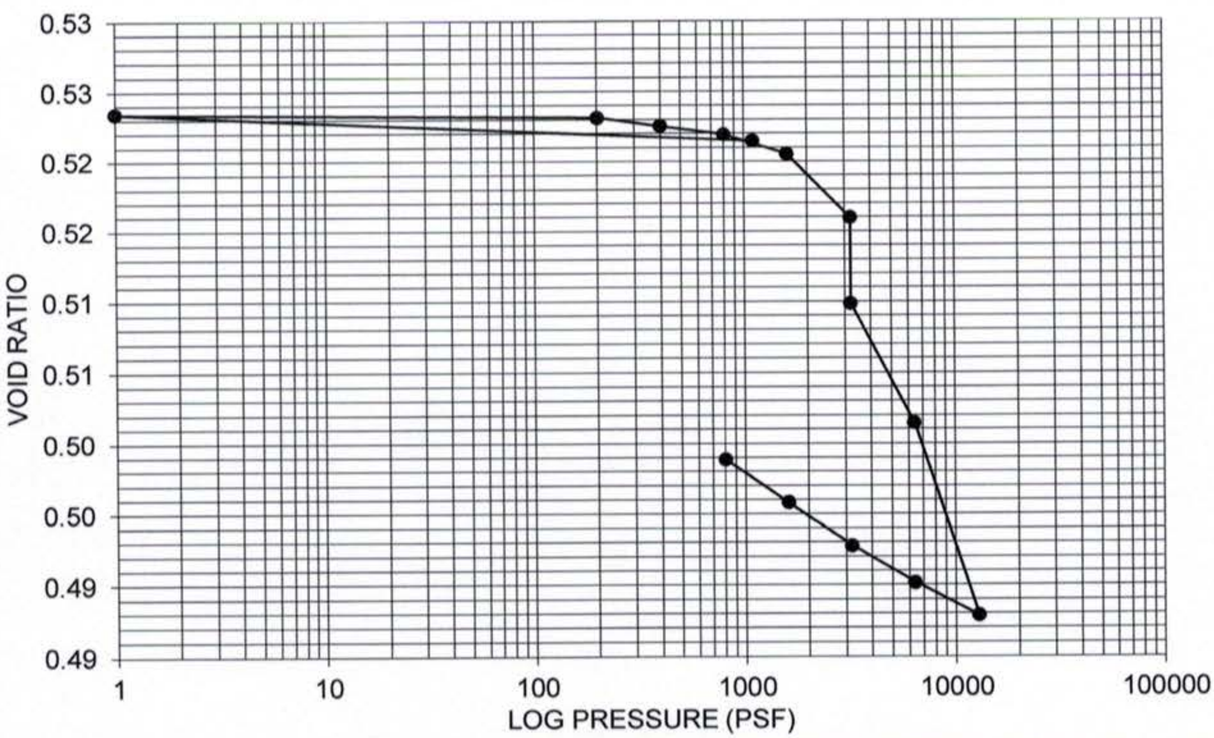


SOIL LABWORKS LLC	**CONSOLIDATION DIAGRAM #3**
	IC: **20020** CONSULTANT: **JAI** CLIENT: **RBM - WESTWOOD**

PLATE C-3

Earth Material:	Alluvium		
Sample Location:	B2@30'	Specific Gravity:	2.65
Dry Weight (pcf):	108.3	Initial Void Ratio:	0.527
Initial Moisture:	8.5%	Water Added At (psf):	3200
Initial Saturation:	42.7%	Consolidation Coef. (Cc):	0.0451
		Reloading Coef. (Cr):	0.0026

CONSOLIDATION DIAGRAM
ASTM 2435-04



SOIL LABWORKS LLC

CONSOLIDATION DIAGRAM #4

IC: **20020** CONSULTANT: **JAI**

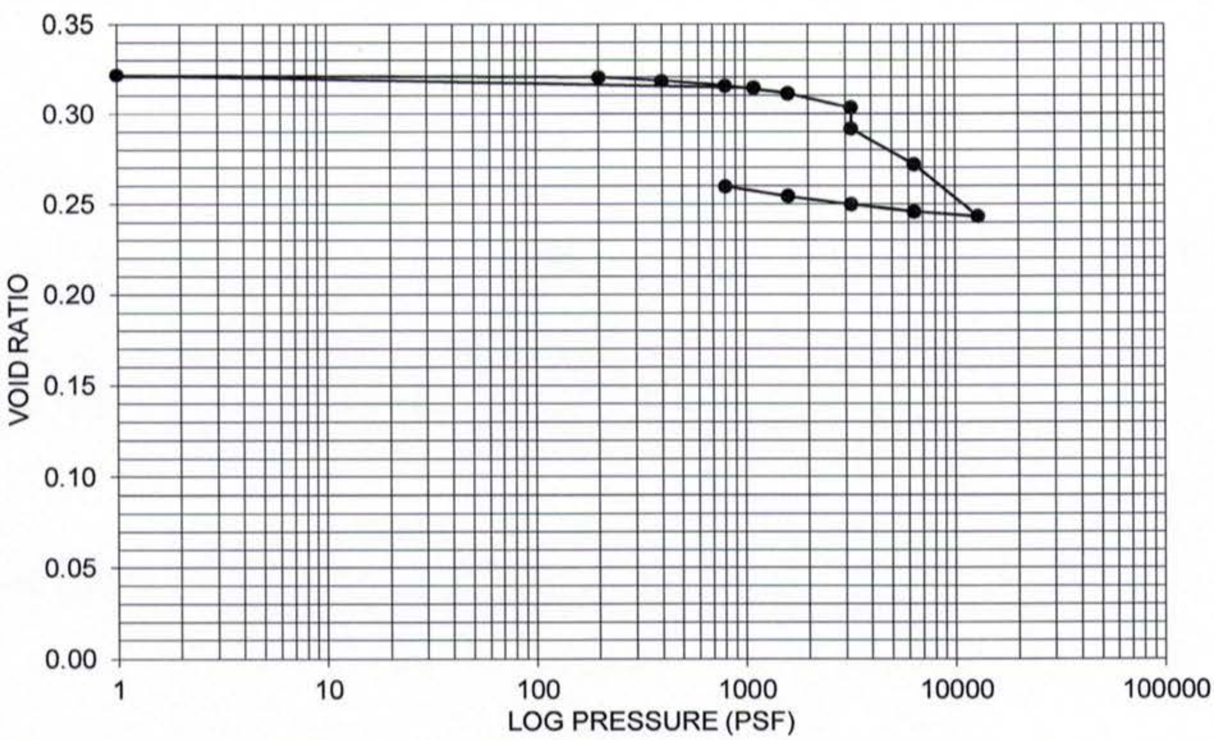
CLIENT: **RBM - WESTWOOD**

PLATE C-4

Earth Material:	Alluvium		
Sample Location:	B2@35'	Specific Gravity:	2.65
Dry Weight (pcf):	124.0	Initial Void Ratio:	0.334
Initial Moisture:	7.1%	Water Added At (psf):	3200
Initial Saturation:	56.4%	Consolidation Coef. (Cc):	0.0948
		Reloading Coef. (Cr):	0.0063

CONSOLIDATION DIAGRAM

ASTM 2435-04



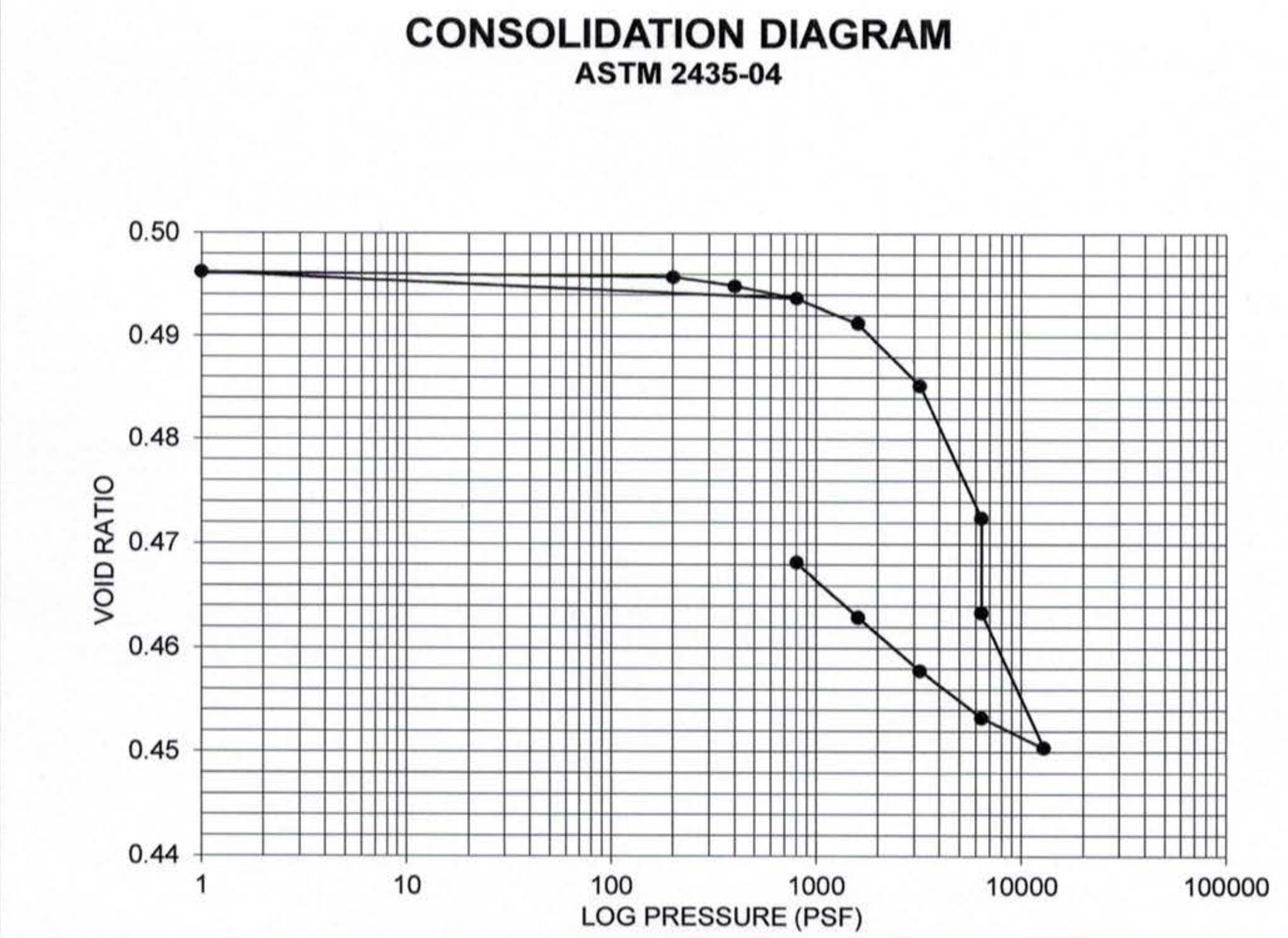
CONSOLIDATION DIAGRAM #5

IC: **20020** CONSULTANT: **JAI**

CLIENT: **RBM - WESTWOOD**

PLATE C-5

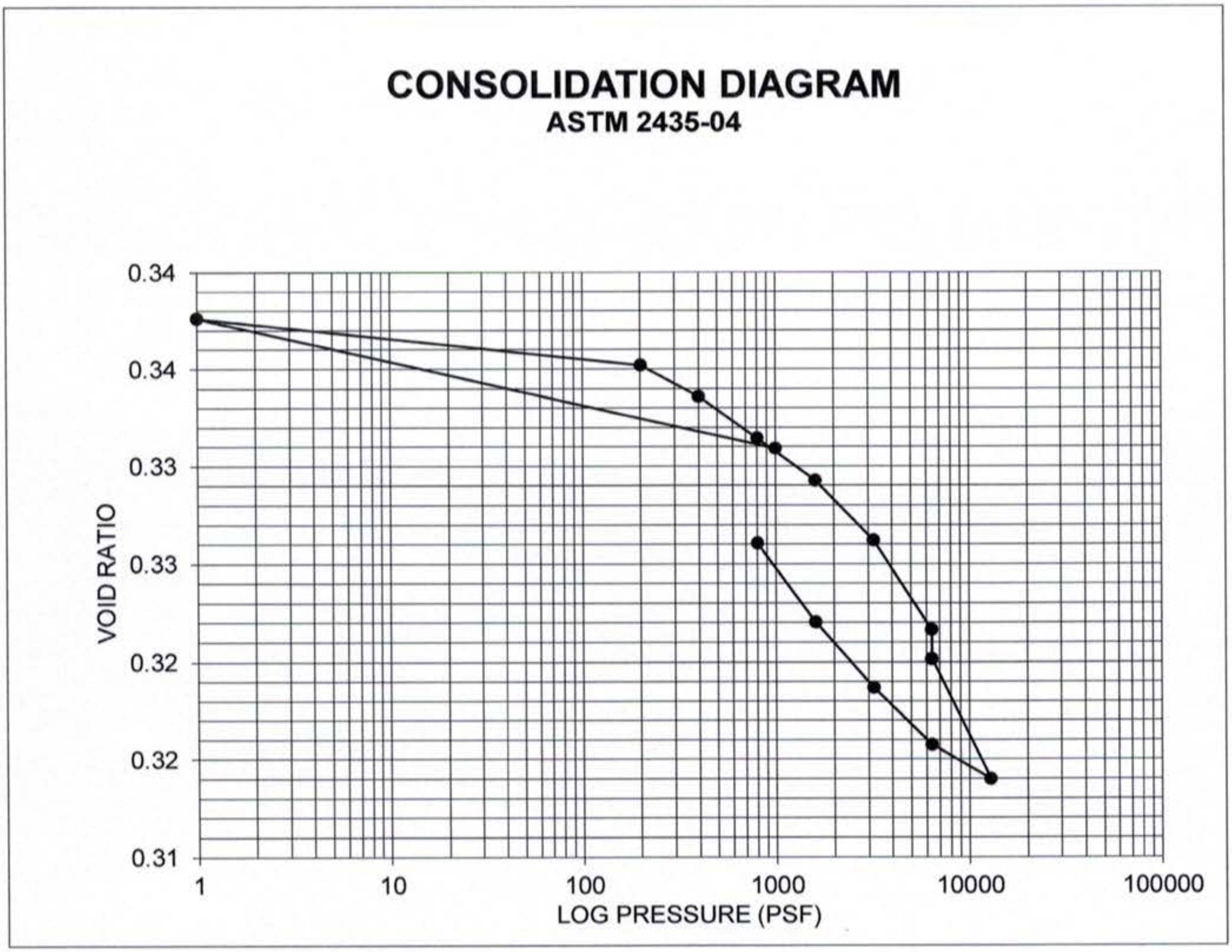
Earth Material:	Alluvium		
Sample Location:	B2@40'	Specific Gravity:	2.65
Dry Weight (pcf):	109.8	Initial Void Ratio:	0.506
Initial Moisture:	18.5%	Water Added At (psf):	3200
Initial Saturation:	96.9%	Consolidation Coef. (Cc):	0.0430
		Reloading Coef. (Cr):	0.0021



SOIL LABWORKS LLC	**CONSOLIDATION DIAGRAM #6**
	IC: **20020** CONSULTANT: **JAI** CLIENT: **RBM - WESTWOOD**

PLATE C-6

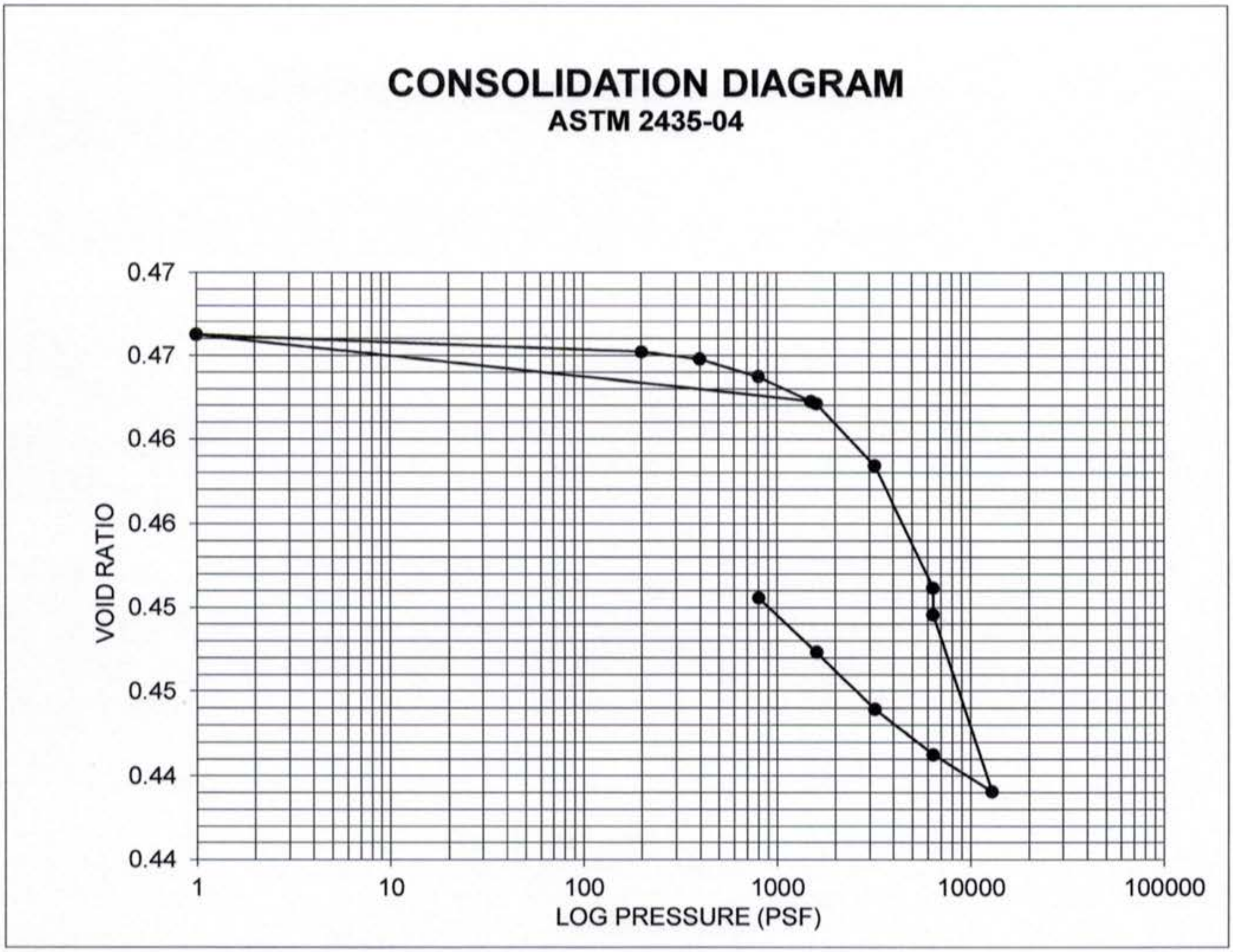
Earth Material:	Alluvium		
Sample Location:	B2@45'	Specific Gravity:	2.65
Dry Weight (pcf):	123.2	Initial Void Ratio:	0.342
Initial Moisture:	12.3%	Water Added At (psf):	3200
Initial Saturation:	95.4%	Consolidation Coef. (Cc):	0.0205
		Reloading Coef. (Cr):	0.0008

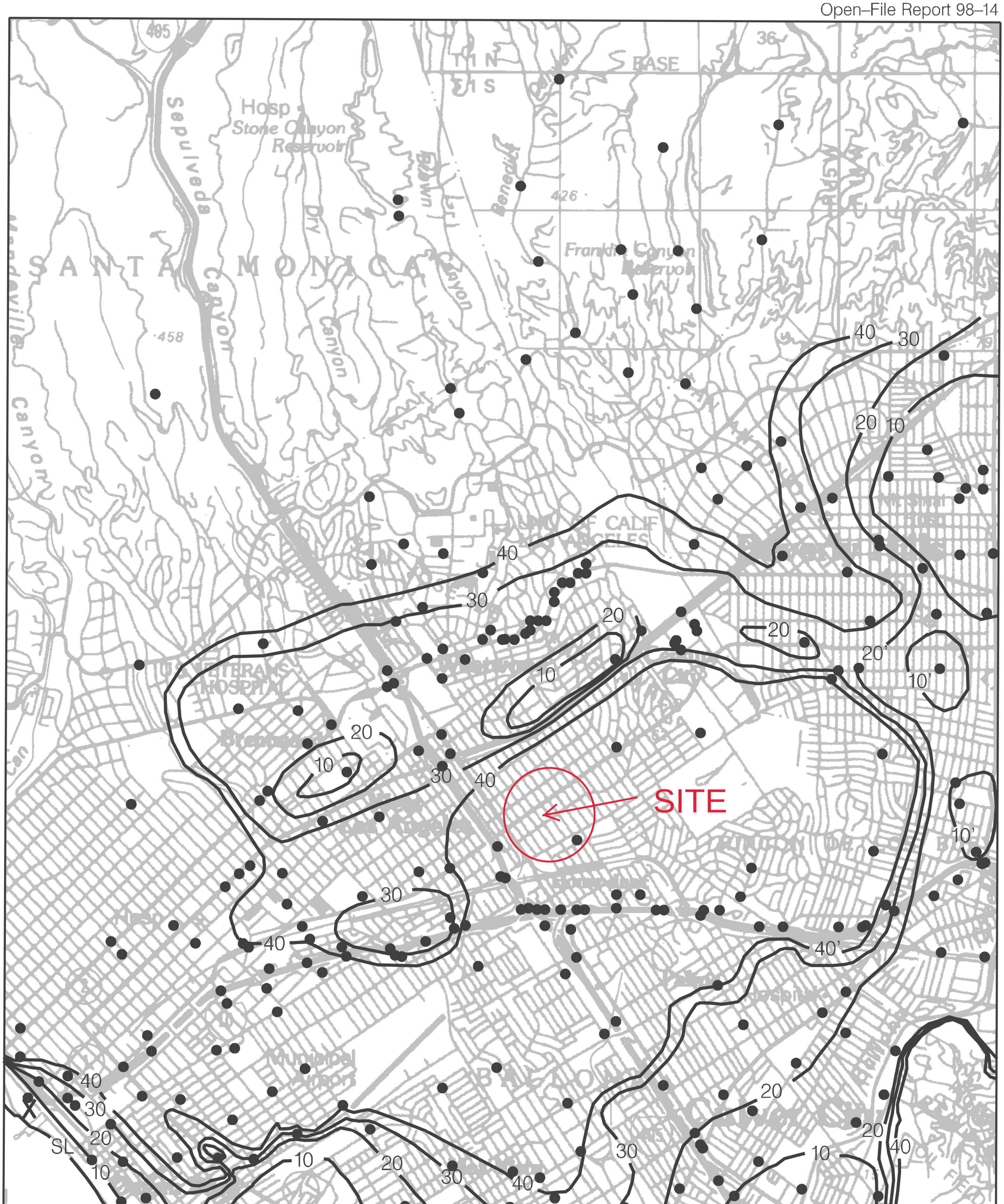


SOIL LABWORKS LLC	**CONSOLIDATION DIAGRAM #7**
	IC: **20020** CONSULTANT: **JAI**
	CLIENT: **RBM - WESTWOOD**

PLATE C-7

Earth Material:	Alluvium		
Sample Location:	B2@50'	Specific Gravity:	2.65
Dry Weight (pcf):	111.9	Initial Void Ratio:	0.478
Initial Moisture:	16.2%	Water Added At (psf):	3200
Initial Saturation:	89.8%	Consolidation Coef. (Cc):	0.0349
		Reloading Coef. (Cr):	0.0018





Base map enlarged from U.S.G.S. 30 x 60–minute series

Plate 1.2 Historically Highest Ground Water Contours and Borehole Log Data Locations, Beverly Hills Quadrangle.

● Borehole Site

30 Depth to ground water in feet

X Site of historical earthquake–generated liquefaction. See "Areas of Past Liquefaction" discussion in text.

ONE MILE

SCALE

IRVINE GEOTECHNICAL Inc

RETAINING WALL

IC: **20020** CONSULT: **JAI**
CLIENT: **RBM WESTWOOD**

CALCULATION SHEET #

CALCULATE THE DESIGN MINIMUM EQUIVALENT FLUID PRESSURE (EFP) FOR PROPOSED RETAINING WALLS. THE WALL HEIGHT AND BACKSLOPE AND SURCHARGE CONDITIONS ARE LISTED BELOW. ASSUME THE BACKFILL IS SATURATED WITH NO EXCESS HYDROSTATIC PRESSURE. USE THE MONONOBE-OKABE METHOD FOR SEISMIC FORCES.

CALCULATION PARAMETERS

EARTH MATERIAL:	ALLUVIUM	WALL HEIGHT	12 feet
SHEAR DIAGRAM:	B-1	BACKSLOPE ANGLE:	0 degrees
COHESION:	85 psf	SURCHARGE:	0 pounds
PHI ANGLE:	28 degrees	SURCHARGE TYPE:	U Uniform
DENSITY	125 pcf	INITIAL FAILURE ANGLE:	30 degrees
SAFETY FACTOR:	1.5	FINAL FAILURE ANGLE:	70 degrees
WALL FRICTION	18 degrees	INITIAL TENSION CRACK:	2 feet
CD (C/FS):	56.7 psf	FINAL TENSION CRACK:	20 feet

PHID = ATAN(TAN(PHI)/FS) = 19.5 degrees

HORIZONTAL PSEUDO STATIC SEISMIC COEFFICIENT (k_h) 0 %g

VERTICAL PSEUDO STATIC SEISMIC COEFFICIENT (k_v) 0 %g

CALCULATED RESULTS

CRITICAL FAILURE ANGLE	50 degrees
AREA OF TRIAL FAILURE WEDGE	59.7 square feet
TOTAL EXTERNAL SURCHARGE	0.0 pounds
WEIGHT OF TRIAL FAILURE WEDGE	7466.7 pounds
NUMBER OF TRIAL WEDGES ANALYZED	779 trials
LENGTH OF FAILURE PLANE	14.0 feet
DEPTH OF TENSION CRACK	1.3 feet
HORIZONTAL DISTANCE TO UPSLOPE TENSION CRACK	9.0 feet
CALCULATED HORIZONTAL THRUST ON WALL	**2975.3 pounds**
CALCULATED EQUIVALENT FLUID PRESSURE	**41.3 pcf**
DESIGN EQUIVALENT FLUID PRESSURE	**45.0 pcf**

THE CALCULATION INDICATES THAT THE PROPOSED RETAINING WALL MAY BE DESIGNED FOR AN EQUIVALENT FLUID PRESSURE OF 45 POUNDS PER CUBIC FOOT.

IRVINE GEOTECHNICAL Inc

RETAINING WALL

IC: 20020 CONSULT: JAI
CLIENT: RBM WESTWOOD

CALCULATION SHEET #

CALCULATE THE DESIGN MINIMUM EQUIVALENT FLUID PRESSURE (EFP) FOR PROPOSED RETAINING WALLS. THE WALL HEIGHT AND BACKSLOPE AND SURCHARGE CONDITIONS ARE LISTED BELOW. ASSUME THE BACKFILL IS SATURATED WITH NO EXCESS HYDROSTATIC PRESSURE. USE THE MONONOBE-OKABE METHOD FOR SEISMIC FORCES.

CALCULATION PARAMETERS

EARTH MATERIAL:	ALLUVIUM	WALL HEIGHT	12 feet
SHEAR DIAGRAM:	B-1	BACKSLOPE ANGLE:	0 degrees
COHESION:	85 psf	SURCHARGE:	0 pounds
PHI ANGLE:	28 degrees	SURCHARGE TYPE:	U Uniform
DENSITY	125 pcf	INITIAL FAILURE ANGLE:	30 degrees
SAFETY FACTOR:	1	FINAL FAILURE ANGLE:	70 degrees
WALL FRICTION	18 degrees	INITIAL TENSION CRACK:	2 feet
CD (C/FS):	85.0 psf	FINAL TENSION CRACK:	20 feet

PHID = ATAN(TAN(PHI)/FS) = 28.0 degrees

HORIZONTAL PSEUDO STATIC SEISMIC COEFFICIENT (k_h) 0.348 %g

VERTICAL PSEUDO STATIC SEISMIC COEFFICIENT (k_v) 0 %g

CALCULATED RESULTS

CRITICAL FAILURE ANGLE	39 degrees
AREA OF TRIAL FAILURE WEDGE	87.6 square feet
TOTAL EXTERNAL SURCHARGE	0.0 pounds
WEIGHT OF TRIAL FAILURE WEDGE	10946.7 pounds
NUMBER OF TRIAL WEDGES ANALYZED	779 trials
LENGTH OF FAILURE PLANE	16.7 feet
DEPTH OF TENSION CRACK	1.5 feet
HORIZONTAL DISTANCE TO UPSLOPE TENSION CRACK	13.0 feet
CALCULATED HORIZONTAL THRUST ON WALL	**4382.4 pounds**

THE CALCULATION INDICATES THAT FOR THE DESIGN GROUND MOTION, THE UNBALANCED FORCE ON RETAINING WALLS IS 4.383 KIPS.

IRVINE GEOTECHNICAL Inc

RETAINING WALL

IC: **20020** CONSULT: **JAI**
CLIENT: **RBM WESTWOOD**

CALCULATION SHEET #

CALCULATE THE DESIGN MINIMUM EQUIVALENT FLUID PRESSURE (EFP) FOR PROPOSED RETAINING WALLS. THE WALL HEIGHT AND BACKSLOPE AND SURCHARGE CONDITIONS ARE LISTED BELOW. ASSUME THE BACKFILL IS SATURATED WITH NO EXCESS HYDROSTATIC PRESSURE. USE THE MONONOBE-OKABE METHOD FOR SEISMIC FORCES.

CALCULATION PARAMETERS

EARTH MATERIAL:	ALLUVIUM	WALL HEIGHT	25 feet
SHEAR DIAGRAM:	B-1	BACKSLOPE ANGLE:	0 degrees
COHESION:	85 psf	SURCHARGE:	0 pounds
PHI ANGLE:	28 degrees	SURCHARGE TYPE:	U Uniform
DENSITY	125 pcf	INITIAL FAILURE ANGLE:	30 degrees
SAFETY FACTOR:	1	FINAL FAILURE ANGLE:	70 degrees
WALL FRICTION	18 degrees	INITIAL TENSION CRACK:	2 feet
CD (C/FS):	85.0 psf	FINAL TENSION CRACK:	25 feet

PHID = ATAN(TAN(PHI)/FS) = 28.0 degrees

HORIZONTAL PSEUDO STATIC SEISMIC COEFFICIENT (k_h) 0.348 %g

VERTICAL PSEUDO STATIC SEISMIC COEFFICIENT (k_v) 0 %g

CALCULATED RESULTS

CRITICAL FAILURE ANGLE	41 degrees
AREA OF TRIAL FAILURE WEDGE	353.3 square feet
TOTAL EXTERNAL SURCHARGE	0.0 pounds
WEIGHT OF TRIAL FAILURE WEDGE	44168.5 pounds
NUMBER OF TRIAL WEDGES ANALYZED	984 trials
LENGTH OF FAILURE PLANE	33.1 feet
DEPTH OF TENSION CRACK	3.3 feet
HORIZONTAL DISTANCE TO UPSLOPE TENSION CRACK	25.0 feet
CALCULATED HORIZONTAL THRUST ON WALL	**21382.4 pounds**

THE CALCULATION INDICATES THAT FOR THE DESIGN GROUND MOTION, THE UNBALANCED FORCE ON BASEMENT RETAINING WALLS IS 21.383 KIPS.

IRVINE GEOTECHNICAL Inc

SHORING PILE

IC: 20020 CONSULT: JAI
CLIENT: RBM WESTWOOD

CALCULATION SHEET #

CALCULATE THE DESIGN MINIMUM EQUIVALENT FLUID PRESSURE (EFP) FOR PROPOSED RETAINING WALLS. THE WALL HEIGHT AND BACKSLOPE AND SURCHARGE CONDITIONS ARE LISTED BELOW. ASSUME THE BACKFILL IS SATURATED WITH NO EXCESS HYDROSTATIC PRESSURE. USE THE MONONOBE-OKABE METHOD FOR SEISMIC FORCES.

CALCULATION PARAMETERS

EARTH MATERIAL:	ALLUVIUM	RETAINED LENGTH	27 feet
SHEAR DIAGRAM:	B-1	BACKSLOPE ANGLE:	0 degrees
COHESION:	85 psf	SURCHARGE:	0 pounds
PHI ANGLE:	28 degrees	SURCHARGE TYPE:	U Uniform
DENSITY	125 pcf	INITIAL FAILURE ANGLE:	30 degrees
SAFETY FACTOR:	1.25	FINAL FAILURE ANGLE:	70 degrees
PILE FRICTION	18 degrees	INITIAL TENSION CRACK:	2 feet
CD (C/FS):	68.0 psf	FINAL TENSION CRACK:	25 feet

PHID = ATAN(TAN(PHI)/FS) = 23.0 degrees

HORIZONTAL PSEUDO STATIC SEISMIC COEFFICIENT (k_h) 0 %g

VERTICAL PSEUDO STATIC SEISMIC COEFFICIENT (k_v) 0 %g

CALCULATED RESULTS

CRITICAL FAILURE ANGLE	53 degrees
AREA OF TRIAL FAILURE WEDGE	273.5 square feet
TOTAL EXTERNAL SURCHARGE	0.0 pounds
WEIGHT OF TRIAL FAILURE WEDGE	34183.6 pounds
NUMBER OF TRIAL WEDGES ANALYZED	984 trials
LENGTH OF FAILURE PLANE	31.6 feet
DEPTH OF TENSION CRACK	1.8 feet
HORIZONTAL DISTANCE TO UPSLOPE TENSION CRACK	19.0 feet
CALCULATED THRUST ON PILE	**14409.8 pounds**
CALCULATED EQUIVALENT FLUID PRESSURE	**39.5 pcf**
DESIGN EQUIVALENT FLUID PRESSURE	**40.0 pcf**

THE CALCULATION INDICATES THAT THE PROPOSED SHORING PILES MAY MAY BE DESIGNED FOR AN EQUIVALENT FLUID PRESSURE OF 40 POUNDS PER CUBIC FOOT. THE FLUID PRESSURE SHOULD BE MULTIPLIED BY THE PILE SPACING.

TOPO! map printed on 03/17/20 from "IRVINE.tpo"

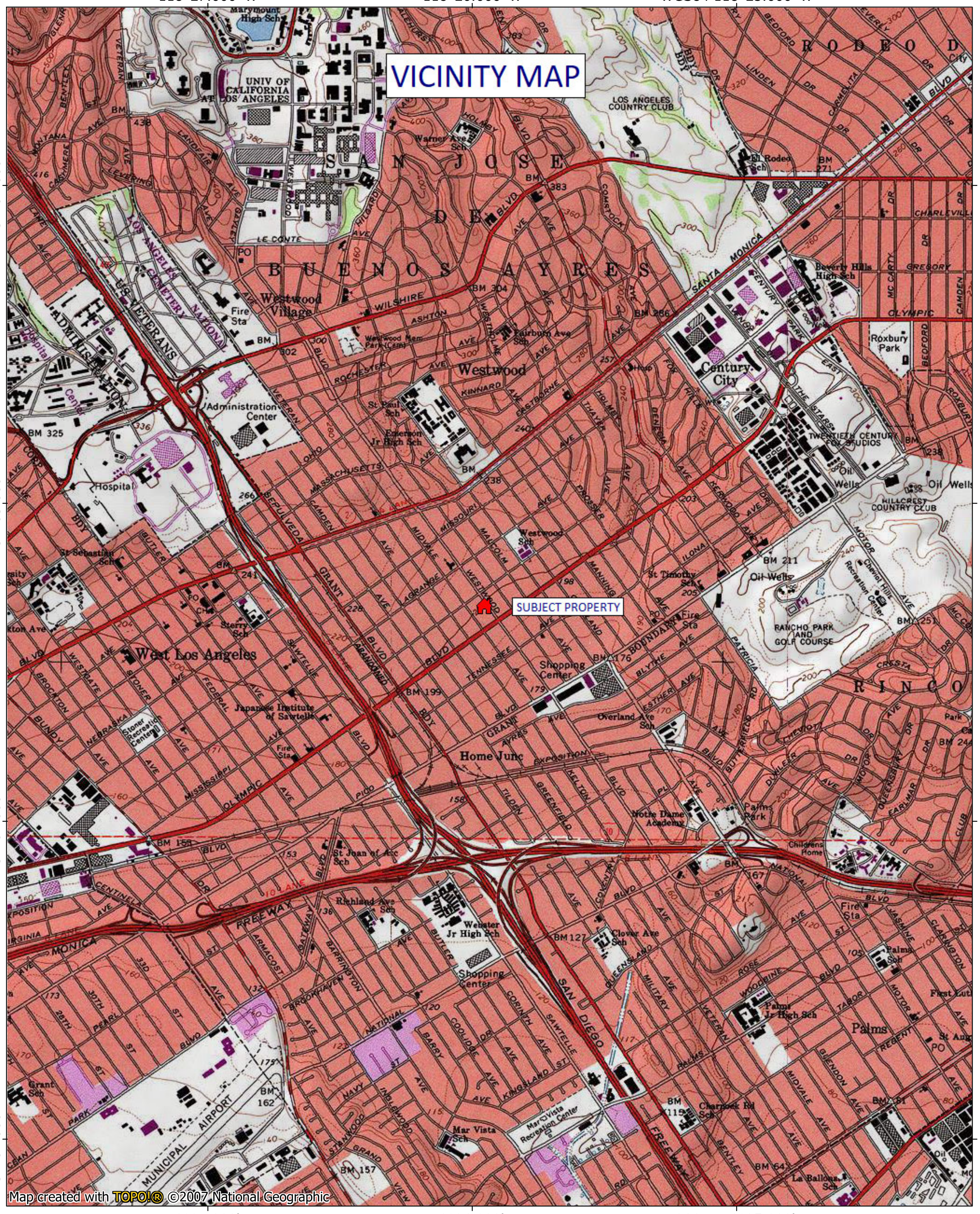
118°27.000' W   118°26.000' W   WGS84 118°25.000' W

34°04.000' N

34°03.000' N

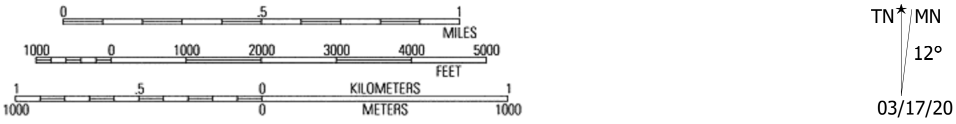
34°02.000' N

34°01.000' N



118°27.000' W   118°26.000' W   WGS84 118°25.000' W

NATIONAL GEOGRAPHIC



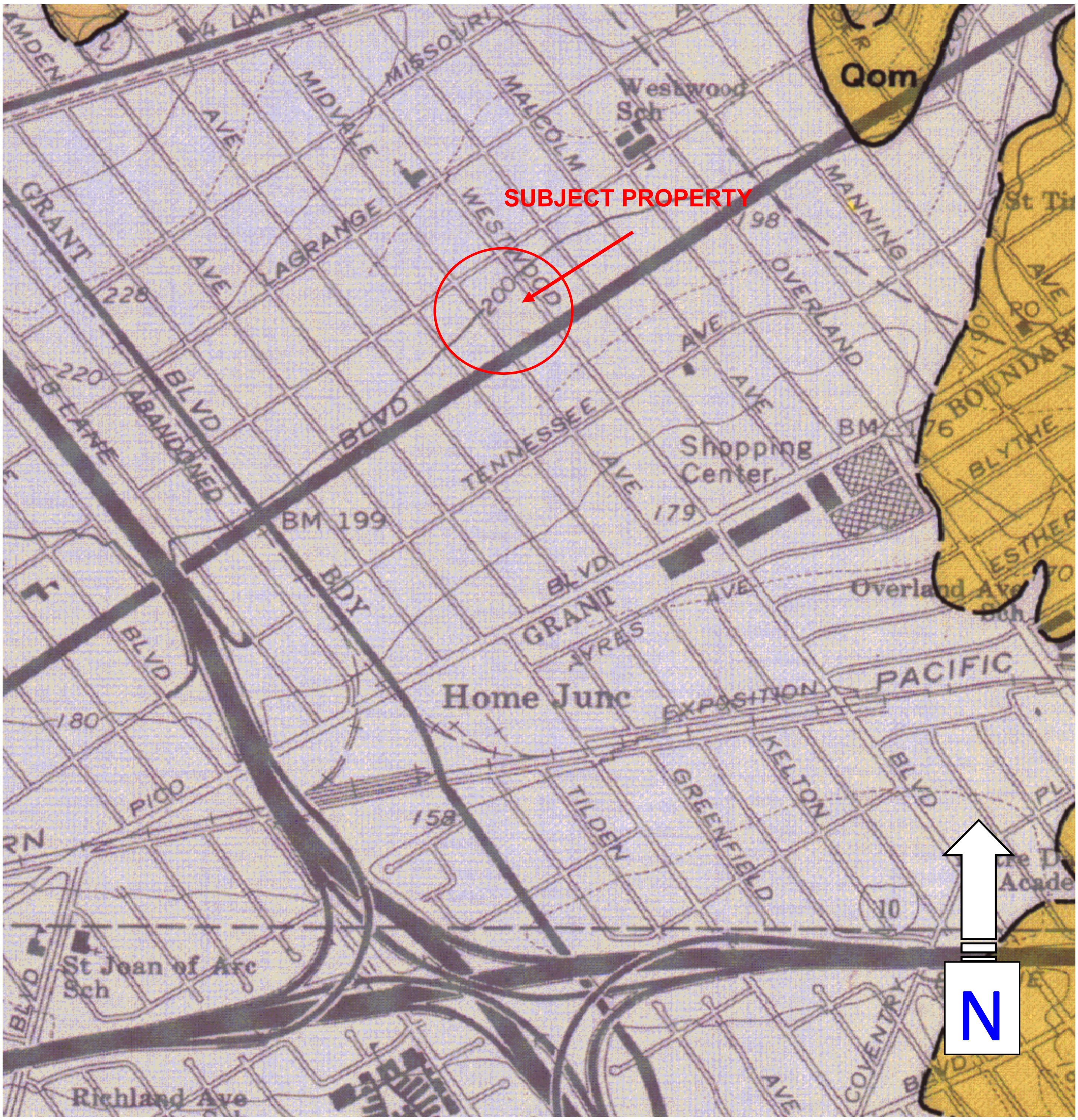
03/17/20

IRVINE
GEOTECHNICAL Inc

REGIONAL GEOLOGIC MAP

IC:	**20020**	CONSULT:	**JAI**
CLIENT	**RBM - WESTWOOD**		
SCALE:	**1" = 1,000'**		

REFERENCE: Geologic Maps of the Santa Monica Mountains and Vicinity, CD Compilation T.W. Dibblee, 2001



IRVINE GEOTECHNICAL Inc

LOG OF BORING

PROJECT	IC20020 RBM WESTWOOD
DRILL DATE	1/30/2020
LOG DATE	1/30/2020
LOGGED BY	C. REYES
DRILL TYPE	HOLLOW-STEM
DIAMETER	8 INCH

SURFACE ELEVATION	213 feet
DRILLING CONTRACTOR	CHARLIES DRILLING
SURFACE CONDITIONS	PARKING LOT; 3 INCHES ASPHALT NO BASE

BORING 1

Sample Type	Sample Depth (feet)	Blows per foot	Moisture (%)	Dry Unit Weight (pcf)	Saturation (%)	USCS Code	Elevation (feet)	Depth (feet)	Lithologic Description
							213.0	0	**FILL:** Sandy Silt, mottled grey and brown, slightly moist, firm
						ML	212.0	1	
							211.0	2	**ALLUVIUM:** Sandy Silt, gray-brown, slightly moist, firm to stiff
							210.0	3	
							209.0	4	
R	5	4/6/6	8.2	89.4	26	ML	208.0	5	
							207.0	6	
							206.0	7	
							205.0	8	
							204.0	9	Silty Sand with Gravel, grey-brown, slightly moist, medium dense
R	10	6/9/10	3.7	108.2	19	SM	203.0	10	
							202.0	11	
							201.0	12	
							200.0	13	
							199.0	14	Silt, grey-brown, moist, firm to stiff
R	15	6/8/10	8.4	96.8	32	ML	198.0	15	
							197.0	16	
							196.0	17	
							195.0	18	
							194.0	19	
R	20	7/8/11	12.1	97.6	46	ML	193.0	20	(continued on next page...)

LOG OF BORING

PROJECT	IC20020 RBM WESTWOOD
DRILL DATE	1/30/2020
LOG DATE	1/30/2020
LOGGED BY	C. REYES
DRILL TYPE	HOLLOW-STEM
DIAMETER	8 INCH

SURFACE ELEVATION	213 feet
DRILLING CONTRACTOR	CHARLIES DRILLING
SURFACE CONDITIONS	PARKING LOT; 3 INCHES ASPHALT NO BASE

BORING 1

Sample Type	Sample Depth (feet)	Blows per foot	Moisture (%)	Dry Unit Weight (pcf)	Saturation (%)	USCS Code	Elevation (feet)	Depth (feet)	Lithologic Description
R	20	7/8/11	12.1	97.6	46	ML	193.0	20	Silt, mottled yellow, brown and gray, moist, stiff
							192.0	21	
							191.0	22	
							190.0	23	
							189.0	24	
R	25	8/10/14	11.3	96.2	12	ML	188.0	25	
							187.0	26	
							186.0	27	
							185.0	28	Sandy Silt with Gravel, yellow-gray, moist, stiff
							184.0	29	
R	30	9/13/18	8.5	108.3	43	ML	183.0	30	
							182.0	31	
							181.0	32	
							180.0	33	
							179.0	34	Silty Sand with Gravel, red-brown, moist, dense
R	35	10/20/16	7.1	124.0	57	SM	178.0	35	
							177.0	36	
							176.0	37	
							175.0	38	
							174.0	39	Clayey Sand, red-brown, very moist, very dense
R	40	10/20/26	18.5	109.8	97	SC	173.0	40	

(continued on next page...)

LOG OF BORING

IRVINE GEOTECHNICAL Inc

PROJECT IC20020 RBM WESTWOOD
DRILL DATE 1/30/2020
LOG DATE 1/30/2020
LOGGED BY C. REYES
DRILL TYPE HOLLOW-STEM
DIAMETER 8 INCH

SURFACE ELEVATION 213 feet
DRILLING CONTRACTOR CHARLIES DRILLING
SURFACE CONDITIONS PARKING LOT; 3 INCHES ASPHALT NO BASE

BORING 1

Sample Type	Sample Depth (feet)	Blows per foot	Moisture (%)	Dry Unit Weight (pcf)	Saturation (%)	USCS Code	Elevation (feet)	Depth (feet)	Lithologic Description
R	40	10/16/26	18.5	109.8	97	SC	173.0	40	Clayey Sand, red-brown, very moist, very dense
							172.0	41	
							171.0	42	
							170.0	43	Silty Sand, red-brown, very moist to saturated, very dense
							169.0	44	
R	45	10/26/40	12.3	123.3	95	SM	168.0	45	groundwater
							167.0	46	
							166.0	47	
							165.0	48	
							164.0	49	
R	50	12/22/38	16.2	111.8	90	SM	163.0	50	

END B-1 @ 50': Water at 45'; No Caving, Fill to 2 feet

IRVINE GEOTECHNICAL Inc

LOG OF BORING

PROJECT IC20020 RBM WESTWOOD
DRILL DATE 1/30/2020
LOG DATE 1/30/2020
LOGGED BY C. REYES
DRILL TYPE HOLLOW-STEM
DIAMETER 8 INCH

SURFACE ELEVATION 205 feet
DRILLING CONTRACTOR CHARLIES DRILLING
SURFACE CONDITIONS PARKING LOT; 3 INCHES ASPHALT 1 INCH BASE

BORING 2

Sample Type	Sample Depth (feet)	Blows per foot	Moisture (%)	Dry Unit Weight (pcf)	Saturation (%)	USCS Code	Elevation (feet)	Depth (feet)	Lithologic Description
							205.0	0	**FILL:** Sandy Silt, mottled grey and brown, slightly moist, medium dense
						ML			
							204.0	1	
							203.0	2	**ALLUVIUM:** Silt, gray-brown, moist, stiff
							202.0	3	
							201.0	4	
R	5	6/7/8	9.5	94.9	34	ML	200.0	5	
							199.0	6	
							198.0	7	
							197.0	8	
							196.0	9	Silty Sand, mottled gray, yellow and brown, slightly moist, medium dense
R	10	6/11/14	6.1	104.4	28	SM	195.0	10	
							194.0	11	
							193.0	12	
							192.0	13	
							191.0	14	
R	15	7/10/13	11.5	92.1	39	ML	190.0	15	Sandy Silt, gray-brown, slightly moist to moist, stiff
							189.0	16	
							188.0	17	
							187.0	18	
							186.0	19	
R	20	8/12/18	10.4	99.5	12	ML	185.0	20	(continued on next page...)

IRVINE GEOTECHNICAL Inc

LOG OF BORING

PROJECT IC20020 RBM WESTWOOD
DRILL DATE 1/30/2020
LOG DATE 1/30/2020
LOGGED BY C. REYES
DRILL TYPE HOLLOW-STEM
DIAMETER 8 INCH

SURFACE ELEVATION 205 feet
DRILLING CONTRACTOR CHARLIES DRILLING
SURFACE CONDITIONS PARKING LOT; 3 INCHES ASPHALT NO BASE

BORING 2

Sample Type	Sample Depth (feet)	Blows per foot	Moisture (%)	Dry Unit Weight (pcf)	Saturation (%)	USCS Code	Elevation (feet)	Depth (feet)	Lithologic Description
R	20	8/12/18	10.4	99.5	12	ML	185.0	20	Sandy Silt, gray-brown, slightly moist, stiff
							184.0	21	
							183.0	22	
							182.0	23	Silty Sand, gray yellow brown, slightly moist, dense
							181.0	24	
R	25	13/17/23	6.4	113.7	37	SM	180.0	25	
							179.0	26	
							178.0	27	
							177.0	28	
							176.0	29	
R	30	18/38/50	14.9	117.1	25	SM	175.0	30	
									END B-2 @ 30': No Water; No Caving, Fill to 18 inches

LOG OF BORING

IRVINE GEOTECHNICAL Inc

PROJECT	IC20020 RBM WESTWOOD
DRILL DATE	1/30/2020
LOG DATE	1/30/2020
LOGGED BY	C. REYES
DRILL TYPE	HOLLOW-STEM
DIAMETER	8 INCH

SURFACE ELEVATION	204	feet
DRILLING CONTRACTOR	CHARLIES DRILLING	
SURFACE CONDITIONS	6 INCHES ASPHALT; NO BASE	

BORING 3

Sample Type	Sample Depth (feet)	Blows per foot	Moisture (%)	Dry Unit Weight (pcf)	Saturation (%)	USCS Code	Elevation (feet)	Depth (feet)	Lithologic Description
						ML	204.0	0	**FILL:** Sandy Silt, mottled grey and brown, slightly moist, medium dense
							203.0	1	
							202.0	2	**ALLUVIUM:** Clayey Sand, dark gray brown, very moist, medium dense
							201.0	3	
							200.0	4	
R	5	4/5/5	16.4	112.2	92	SC	199.0	5	
							198.0	6	
							197.0	7	
							196.0	8	
							195.0	9	Silty Sand, gray to yellow-brown, moist, medium dense
R	10	5/5/6	12.6	106.8	61	SM	194.0	10	
							193.0	11	
							192.0	12	
							191.0	13	
							190.0	14	
R	15	6/9/12	13.6	107.2	66	SM	189.0	15	
							188.0	16	
							187.0	17	
							186.0	18	Sandy Silt, mottled gray, yellow, and brown, moist, stiff
							185.0	19	
R	20	6/7/12	15.9	104.8	73	ML	184.0	20	(continued on next page...)

LOG OF BORING

PROJECT	IC20020 RBM WESTWOOD
DRILL DATE	1/30/2020
LOG DATE	1/30/2020
LOGGED BY	C. REYES
DRILL TYPE	HOLLOW-STEM
DIAMETER	8 INCH

SURFACE ELEVATION	204 feet
DRILLING CONTRACTOR	CHARLIES DRILLING
SURFACE CONDITIONS	PARKING LOT; 3 INCHES ASPHALT NO BASE

BORING 3

Sample Type	Sample Depth (feet)	Blows per foot	Moisture (%)	Dry Unit Weight (pcf)	Saturation (%)	USCS Code	Elevation (feet)	Depth (feet)	Lithologic Description
R	20	6/7/2012	15.9	104.8	73	ML	184.0	20	Sandy Silt, mottled gray, yellow, and brown, moist, stiff
							183.0	21	
							182.0	22	Silty Sand, gray-brown, moist, dense
							181.0	23	
							180.0	24	
R	25	7/9/12	14.1	110.1	74	SM	179.0	25	
							178.0	26	
							177.0	27	
							176.0	28	Clay, gray-brown, moist, very stiff
							175.0	29	
R	30	7/10/11	26.4	95.2	95	CL	174.0	30	

END B-3 @ 30': No Water; No Caving, Fill to 18 inches

LOG OF BORING

IRVINE GEOTECHNICAL Inc

PROJECT	IC20020 RBM WESTWOOD
DRILL DATE	1/30/2020
LOG DATE	1/30/2020
LOGGED BY	C. REYES
DRILL TYPE	HOLLOW-STEM
DIAMETER	8 INCH

SURFACE ELEVATION	202 feet
DRILLING CONTRACTOR	CHARLIES DRILLING
SURFACE CONDITIONS	3 INCHES ASPHALT 2 INCHES BASE

BORING 4

Sample Type	Sample Depth (feet)	Blows per foot	Moisture (%)	Dry Unit Weight (pcf)	Saturation (%)	USCS Code	Elevation (feet)	Depth (feet)	Lithologic Description
							202.0	0	**FILL:** Sandy Silt, mottled grey and brown, slightly moist, medium dense
						ML	201.0	1	
							200.0	2	**ALLUVIUM:** Silty Clay, dark brown, moist, firm to stiff
							199.0	3	
							198.0	4	
R	5	3/3/3	12.4	98.5	48	CL	197.0	5	
							196.0	6	
							195.0	7	Silty Sand, grey-brown, moist, dense
							194.0	8	
							193.0	9	
R	10	7/9/12	5.6	117.3	37	SM	192.0	10	
							191.0	11	
							190.0	12	
							189.0	13	
							188.0	14	Sandy Silt with some Gravel, yellow-brown, moist, firm to stiff
R	15	6/8/10	12.9	105.1	60	ML	187.0	15	
							186.0	16	
							185.0	17	
							184.0	18	
							183.0	19	
R	20	6/8/10	19.3	104.9	89	ML	182.0	20	

(continued on next page...)

LOG OF BORING

IRVINE GEOTECHNICAL Inc

PROJECT	IC20020 RBM WESTWOOD
DRILL DATE	1/30/2020
LOG DATE	1/30/2020
LOGGED BY	C. REYES
DRILL TYPE	HOLLOW-STEM
DIAMETER	8 INCH

SURFACE ELEVATION	202 feet
DRILLING CONTRACTOR	CHARLIES DRILLING
SURFACE CONDITIONS	PARKING LOT; 3 INCHES ASPHALT NO BASE

BORING 4

Sample Type	Sample Depth (feet)	Blows per foot	Moisture (%)	Dry Unit Weight (pcf)	Saturation (%)	USCS Code	Elevation (feet)	Depth (feet)	Lithologic Description
R	20	6/8/10	19.3	104.9	89	ML	182.0	20	Silt, yellow brown, moist, stiff
							181.0	21	
							180.0	22	
							179.0	23	
							178.0	24	Sandy Silt, brown, moist, firm to stiff
R	25	6/8/10	16.0	103.6	71	ML	177.0	25	
							176.0	26	
							175.0	27	
							174.0	28	
							173.0	29	
R	30	6/8/11	19.9	100.8	82	ML	172.0	30	
									END B-4 @ 30': No Water; No Caving, Fill to 2 feet

SITE PLAN

PROJECT: IC20020 - RBM WESTWOOD

CONSULTANT: JAI | SCALE: 1" = 30'

LEGEND

B1 --- NUMBER & LOCATION OF BORING